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August, 1922

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Fifty Years of Dairy Progress

PRODUCTION

and Plans for Fifty More

EXTENSION SERVICE OF THE
COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN
MADISON

NO MATTER WHAT TRIALS beset agriculture, dairying is and will always continue to be one of its profitable and its most secure ventures. The reasons are not far to seek. Ever since the days of primitive man the human race has used large proportions of animal food. As population presses, meat is partially replaced by vegetables in the diet. Nowhere, however, has animal food been entirely abandoned. Since the dairy cow is the most economical producer of human food from the grain and roughages of the farm, the increased consumption of dairy products is coincident with the increase of human population. This is one vital reason why dairying must continue.

Of all the enterprises in which men engage, livestock husbandry is the most alluring and the most enjoyable. But livestock husbandry rests wholly upon mammalian life—life that depends upon mother's milk. In ordinary farming the milk of the cow is freely substituted for that of other animals in the nurture of the growing young. But this reason, important as it must be, is one of the least of the reasons why dairying must continue.

The cow has been most appropriately designated " the foster mother of the human race." Childhood's dependence upon milk for its normal growth and healthy development is so absolute and so vital to our national welfare that dairy farming is rapidly coming to be the one indispensable industry. Textiles may be "fabricated," foods produced by "synthetic processes," building materials "substituted," but **"there are no substitutes for milk. It is the one protective food in the human dietary."**

Hence, dairying cannot be overdone and the dairy cow will never be replaced, neither in the nurture of the race nor the fundamental economics of the farm.

K. L. Hatch.

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The Future of Wisconsin Dairying

H. L. Russell

THE STABILITY of Wisconsin's agriculture rests upon the rock of dairying. No more economical machine has ever been devised by nature than the dairy cow; and one outstanding feature of these times of stress is that dairying has stood the test of deflation better than any other form of husbandry. In comparison with those states which produce dominantly a single crop—whether it is cotton, wheat, hogs, or cattle—Wisconsin, by reason of its diversification and specialization, is recognized the nation over as being in the most stable position of any commonwealth.

Roger Babson, the eminent statistician, recently stated that no state in the Union in which agricultural interests were dominant was in better financial shape than Wisconsin. It is his unqualified opinion that the present economic position of this state rests more upon the basis of its dairy production than upon any other factor.

WISCONSIN LAND VALUES FALL BUT SLIGHTLY

While dairy products during the war did not in the main undergo the wide market fluctuations which occurred with other food products, it is significant that they did not fall so low in the process of deflation. Stability makes for security, for a continuously prosperous condition, and is much to be preferred to the feverish, speculative condition engendered by wide price fluctuations.

This stable situation is reflected back on the value of the land itself. Fortunately, the post-war boom in land values that struck the corn belt did not run to any such lengths in this state. The increase in the price of land was only moderate. With the inevitable deflation, which is sure to occur in any period of mush-

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This address was delivered at the University of Wisconsin on January 30, 1922, at the celebration of the semi-centennial of the establishment of the Wisconsin Dairymen's Association, which has had so marked an influence on the development of dairying in this state. Other addresses made on this occasion have been or will be printed in the series, "Fifty Years of Dairy Progress and Plans for Fifty More." The circulars are *Marketing* (145), *Competition* (150), and *Advertising*.

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room expansion, land values have consequently not declined in any such way as in those sections. Wisconsin, therefore, stands as rockribbed in its agriculture as in its ancient granite hills from which much of its glaciated fertility has been derived.

HAS A SOUND FUTURE POLICY

If dairying has made Wisconsin famous in the past, the question may well be asked: Is it not wise to follow the same path in the future? We have just passed the fiftieth milestone of dairy progress. Shall we continue on the same road, or shall we, as a state, change our accepted policies? Some perhaps are fearful that we may overdo the dairy industry and become a single crop state, as the wheat, cotton or corn belt states to the south or west. But such a view overlooks the fundamental fact that milk has a wider diversity of outlets for its use than any other farm product.

DIVERSITY IN MILK OUTLETS

Most agricultural crops are marketed through a limited number of channels. Wheat, the largest staple crop, finds its main outlet in flour. Meats from different animals even compete in a degree with each other, although the product of the steer or hog finds relatively a wider diversity of use than the grain or field crops.

Milk, however, has a wider adaptability for non-competititve use than any other leading farm staple. Forty-four per cent of the product of the dairy cow is used in a fresh or untreated condition, a primary food product. Practically one-half of all milk produced undergoes a process of preparation, a type of manufacturing, that changes radically its form and appearance, but not its nutritional value. Somewhat over one-third of all production is used as butter, made either in factory (20%) or churned on the farm (16%). Cheese, a radically different product in taste and use, consumes a relatively small part (4%) of the nation's milk supply. Even the confection, ice cream, which is so characteristic an American product, utilizes as much milk (4%) in its manufacture as the great Wisconsin staple, cheese. The newer types of dairy products—condensed, evaporated, and dried milks—the use of which has been so phenomenally expanded during the war, require about 8 per cent for their needs. The best available estimates indicate that approximately 7 per cent of total milk production goes into feed for live stock, wastage, and loss.

Few if any of these products are really competitive. To a limited extent condensed milks may replace the use of the fluid product, but the immunity from spoilage in the condensed, evaporated or dried product makes it possible to extend the distribution of milk in this form far beyond the limits which previously have restricted its use.

ARE DAIRY PRICES DEPENDENT ON EXPORTS?

The argument is frequently advanced that the price of farm products is largely controlled by the worth of those products in the export markets of the world, and that where a surplus of any product is produced, even though that surplus is small, the price which is set for the entire crop at points of production is dependent on that which is received for the surplus where it is consumed. This principle is undoubtedly true with reference to such a world-wide staple as wheat. The price which the Nebraska or Dakota farmer receives for his wheat is essentially the world price in Liverpool, less what it costs to get that wheat from the plains of Nebraska and Dakota to the Liverpool market; whatever may be the amount of wheat produced in America, whether we consume it or not, whether that surplus is relatively large or small, it is true that the market is largely determined on the other side of the ocean, and the American farmer receives an amount for his wheat less the cost of getting it over there.

While this is true with reference to a non-perishable product of such general use as wheat, or even meat—more particularly cured meats—it is not true with regard to dairy products, because the exportable surplus of these products is so insignificant that this small amount exerts no appreciable influence in the European situation.

Under pre-war conditions, in 1913 and 1914, the United States was shipping only two-tenths of 1 per cent of our total dairy production abroad. With the oncoming of the war and the cutting off of the southern supply from Australia, New Zealand and the Argentine, it became necessary for Europe to draw larger supplies from America; but even in 1919, when the maximum of exports was going abroad, the total amount exported was only 2½ per cent of our dairy production.

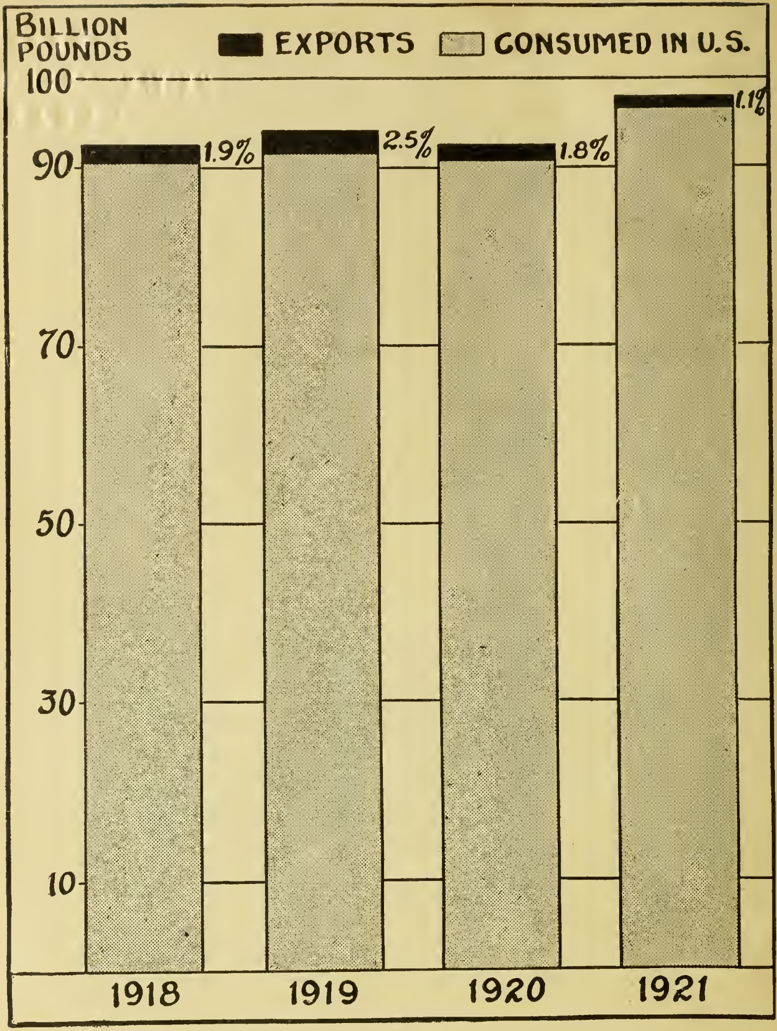

Fig. 1.—RELATION OF EXPORTS TO PRODUCTION

This proportion is so small that it is almost negligible except with condensed and evaporated products.

With this situation in mind, it is apparent that the exportable surplus of total dairy products does not bulk very large in the world's markets and, hence, is not likely to affect in a general way the price of milk here in America. Locally this general condition may not always govern, as in the case of condensed milks, the present national production of which is so much in excess of domestic consumption that the exportable surplus is quite a material factor in the world's markets.

THE INTERNATIONAL BUTTER BALANCE

To get the proper perspective for America to judge of the future, it is advantageous to glance at the international situation, because in the next fifty years this nation, or at least Wisconsin, will have to consider specifically this problem. Statistics are not readily available to give a picture of the entire world dairy situation, but as butter is the index of the industry as a whole, and it is in this particular field that most complete data can be secured, the international butter balance may be of service. At the present time the surplus butter of the various exporting countries is only about two-thirds of what it was before the war. Few countries are really in position to export. Denmark, Russia (including Siberia), Finland, Sweden, the Netherlands and France were the export European nations prior to the war; and the Argentine, Australia and New Zealand in the southern hemisphere.

Production in Europe is still materially below normal, but the output of the southern hemisphere is increasing rapidly. Within the past two years their exports have increased over a third. The Argentine, Australia and New Zealand shipments to the United Kingdom increased, from 1913 to 1921, from 102 million to 228 million pounds. The costs of production in these countries are notably lower than those in Wisconsin. The climatic conditions of New Zealand make it possible for dairy cattle to be pastured the year round; no barns are necessary. In fact, the great majority of animals are only milked in small buildings, so that the amount of capital which is necessary for milk production is much less than it is in Wisconsin. This output of the southern hemisphere that is so rapidly increasing must find its outlet in the northern countries, where density of consuming population forms the market.

Butter also comes into the northern markets at a time to exert the maximum influence upon the price of the home-made product, for the flush of their summer production occurs in our winter period when the price of butter is generally at the maximum. Naturally it may be expected that the British colonial product will find its normal outlet in the English market, but whether

Europe bids for this southern product or whether it seeks *our* shores turns wholly on the matter of relative price, as was the case last year when Danish butter came by the shipload to our markets.

Winter dairying has had to compete for years with butter placed in cold storage, but to an increasing degree America may expect keener competition with the product of the southern hemisphere, as their production outruns their own consumption. For this reason the dairy tariffs of the new Fordney bill are of special moment to the butter interests of this country.

COLD STORAGE HAS STABILIZING INFLUENCE

Few consumers or producers realize how powerful an effect cold storage exerts on the market price of manufactured dairy products. Many consider that storage is a menace to production; that it induces speculation, and frequent efforts are noted to restrict the operation of this market agency. But were it not for the stabilizing influence of cold storage that takes out of the market at the flush of production a very large quantity of product (between 20 and 25 per cent of total butter production for 1921), the fluctuations in price between the summer and winter product would be much greater than they are now. This relatively large amount taken out of the market at the flush of production helps to sustain the early summer price.

WISCONSIN'S POSITION IN DAIRY PRODUCTION

The relative position of Wisconsin in comparison with the entire United States in dairy production is shown in Table I:

Table I.—Production of Manufactured Dairy Products

1920	United States	Wisconsin		
Cheese	(Pounds)			
American	254,000,000	188,500,000	74%	76%
Swiss, Brick, etc.	72,000,000	58,700,000	81.5	
Creamery Butter	866,000,000	99,800,000	11.5%	
Processed Milks				
Condensed, Evaporated	1,702,000,000	453,000,000	26+%	
Dried, Malted, Powdered	89,600,000	21,500,000	24%	

More and more Wisconsin's dairy production is going to the cities as market milk, as is also the case with New York, but in spite of this increase, the production of cheese and evaporated milk products has been steadily and rapidly increasing. Butter is hardly holding its own, due to the inroads of the city milk supplies. The dried milk industry is yet in its infancy, but already is showing indications of a healthy growth.

With as large a percentage of total national production made within the limits of a single state, the question may properly be asked whether we are in danger of overdoing dairying or not. The answer to this question depends in considerable measure on what is happening in the rest of the United States. On the whole, the number of dairy cows in the nation at large is increasing but slightly, as is shown by the following figures:

Number of Dairy Cows

	1917	1920	1921
United States	22,894,000	23,619,000	23,321,000
Wisconsin	1,750,000	1,836,000	1,828,000

The increase in Wisconsin for the past census decade (1910-1920) was 354,870 head, or a trifle less than one-fourth. Much of this increase (58%) has been in the northern counties, where the cut-over lands are being converted into farms. About 25 per cent of the increase has come in those counties that may be considered in the fluid or market milk zone of Milwaukee and Chicago. In no small number of the older counties the saturation point seems to have been reached. Some counties, especially in the southeastern part of the state, are even declining.

Production may be increased, not only through increase in number of dairy animals, but also through the use of better producers. It is significant that while the number of dairy cattle in the state increased 4.2 per cent from 1917 to 1921, the increase in total milk production, which is the important thing, was over 7 per cent.

Unquestionably the resources of the state will permit of greatly increased expansion of this industry, especially in the northern and central portions. Success in this direction must, of course, be correlated with ability to grow the necessary forage crops (corn, hay, etc.) rather than to import such bulky crops from outside at present high costs of transportation. The development of the new north is especially contingent on increased land reclamation, as the present acreage of land actually in use is not sufficient to maintain existing herds. With the possibility and opportunity for marked future expansion, the problem becomes more and more imminent as to whether consumption can be made to keep pace with production.

FUTURE CONSUMING POSSIBILITIES

If 44 per cent of total milk production is consumed as a primary food, i. e., in a raw or unmanufactured state, can Wisconsin markedly increase this use? Fresh milk is so perishable a product that it must necessarily be consumed relatively near the point of production. Increased consumption can, therefore, only be brought about through (a) growth in consuming population, and (b) increased per capita use of milk.

INCREASED CONSUMPTION DUE TO POPULATION INCREASE

This state is fortunately situated in the matter of fluid milk markets. Just outside of its borders are the rapidly growing urban populations of Chicago, the twin cities of St. Paul and Minneapolis, Duluth, and the iron and copper ranges of Minnesota and Michigan. In 1920 these consuming centers had a population of 3,621,000. Within the last ten years these border cities have absorbed an increase in fluid milk of over two and one-half fold. Chicago already is the empire city of the great interior of the United States. Its geographical position makes it obvious that its future growth is absolutely certain to outstrip that of any other inland city. Its milk supply comes from a line north, not south, of that city. It might draw its supply from Michigan, but, fortunately for Wisconsin, it secures a constantly increasing proportion of its fluid milk from Badger dairymen.

The expansion of population within the state is also certain to develop more rapidly in the future than in the past. Cheap power, which is avaliable through the development of our hydroelectric possibilities and lower labor costs in comparison with the overindustrialized east, due to lower food costs, are destined to develop manufacturing and industry in Wisconsin more rapidly in the future than in the past. No one realizes this situation more keenly than does the New England manufacturer. When

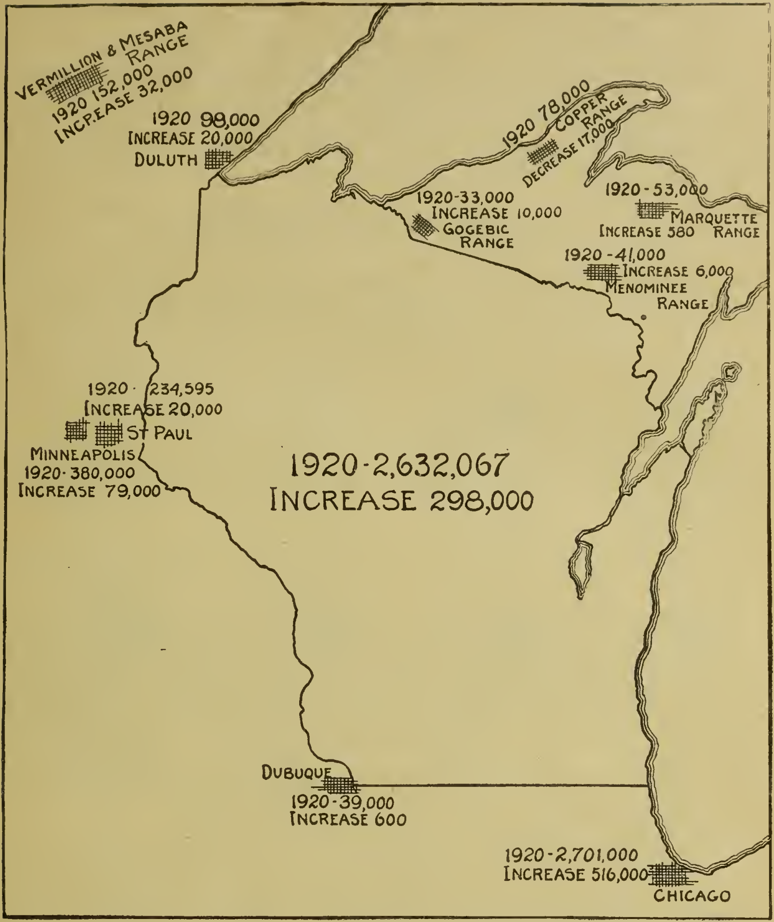

Fig. 2.—EVERY ADDITIONAL MILLION CONSUMERS REQUIRES THE OUTPUT OF 200,000 COWS.

In ten years the border cities of Wisconsin have increased their use of fluid milk two and one-half times.

industrial New England sends over $500,000,000 to the South and West for food supplies to make up the deficit in her food needs to feed her mill operatives, it is obvious that industry will sooner or later gravitate to those regions where food can be more cheaply secured and where labor costs are, therefore, less. Massachusetts now produces only an eighth of her food requirements and Rhode Island only one-twentieth. Let us learn a lesson from the over industrialized East and keep that proper balance between farm and factory that makes for a symmetrical rather than a lopsided commercial development.

Every additional million consumers will require the production of 200,000 cows. The output of more than one-half the total increase in dairy cattle for the entire decade would, therefore, be absorbed by the increase in population that has already developed in this period in the trade zone that is tributary to this state.

INCREASE IN PER CAPITA USE

Milk. The possibilities of expanding the per capita consumption of fluid milk have scarcely been touched. The dairy business is in a unique position in this regard. No other food product in general use excels it in healthfulness and desirability. The recent discoveries (many of which have been accomplished here at the Wisconsin Experiment Station) show the great efficiency of milk as a protective food for the growth and repair of body tissues.

The widespread diffusion of knowledge about the hygienic value and nutritive worth of milk is steadily making headway, not only in our schools, where it is reaching the young of the nation, but through the medium of the "milk campaigns" that are being carried on by the various state and national dairy councils, the United States Department of Agriculture, and the colleges of agriculture. Wherever these have been attempted they have resulted in a very marked increase (from 20 to 30%) in the amount of fluid milk that has been consumed.

Ice cream. Closely related to the use of market milk is that of ice cream, which is generally regarded as a perishable dairy product. Many people do not realize that the ingredients from which ice cream is now commercially made may be suitably kept for months and transported anywhere. It is, therefore, a manufactured or processed article which is subject to shipment for any distance. The outlet for milk through this channel is rapidly expanding. In 1920 there was a 13 per cent increase in volume over that of the preceding year. There is no question that a marked increase in this product could easily be maintained.

Butter. With butter especially of the different forms of dairy products, the rate of consumption varies inversely with the price. The consuming population undoubtedly prefers butter to substitutes, but under the economic pressure of price and profuse advertising, the use of butter substitutes has been greatly extended in recent years, not only in America but in Great Britain as well. If the consumption of butter and that of oleomargarine is combined, the figures show a surprising uniformity year by year.

In 1909 the relative consumption of oleomargarine in this country to butter was about 6¾ per cent; in the year 1920 the use of these butter substitutes had increased to 20 per cent, with a material declination this last year. Considerable increase in the use of butter could be made if butter producers themselves would more consistently use their own product, instead of selling it and buying oleomargarines for their own table. It is rather interesting to note that the New England states, which have the highest cow population per capita of any state in the Union also have the unique distinction of being the highest per capita purchasers of butter substitutes.

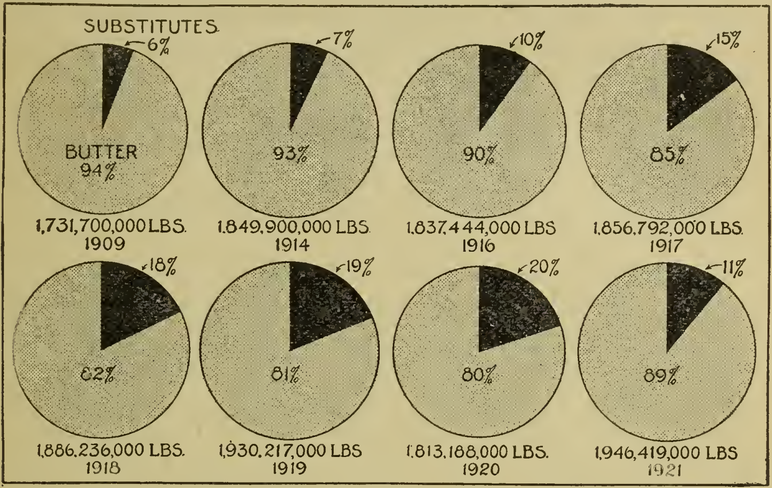

Fig. 3.—PRODUCTION OF BUTTER AND ITS SUBSTITUTES.
(United States.)

As the use of substitutes increases, butter production declines.

The question of quality also affects consumption profoundly. Rarely is the market overstocked with a high quality of butter. Nearly always it is the more inferior product that contributes to any accumulating surplus. The reduced returns which come to many creameries through a low grading product is a source of much financial loss. The returns given weekly in any of the dairy papers will generally show a range of from 6 to 8 cents per pound. Not infrequently the returns will show fully a fourth of the entire number of creameries receiving less than the average price for the entire sales reported any week. Where a creamery is turning out so inferior an output as to suffer this handicap in the market, it is not only losing a possible profit to its own patrons but it is also reducing the consumption of butter as a food product.

Most butter surplus countries, like New Zealand, Australia, Denmark, Sweden and Holland, maintain government supervision over exports to standardize quality. If New Zealand butter can be shipped 8,000 miles and reach our markets in shape to outsell much of our fresh-made product, as producers we have ourselves to blame. This country is not likely to bulk largely in the matter of export of either butter or cheese. These products can be made cheaper in other portions of the world, so that the needs of the deficit consuming areas in Europe are likely to be supplied first by exports from other surplus-producing countries than America. But it is possible for us to improve the quality of these products so that our domestic consumption could be materially stimulated.

Cheese. Wisconsin production of cheese, both American and foreign types (Swiss, limburger and brick), is so largely in excess of home consumption that the development of markets outside of the state becomes imperative. As is so frequently the case, a brisk market is dependent on general economic conditions. For instance, when cotton is king in the South, cheese moves freely in this direction, but 10-cent cotton greatly reduces consumption in this section through the reduction of the buying power of the people. Under ordinary trade conditions, fully 40 per cent of our American product finds an outlet in the southern trade.

The per capita use of cheese in the United States is exceedingly low, only about 3.8 pounds per capita; whereas, in European nations, like Switzerland, the United Kingdom and Germany, it runs from 10 to 25 pounds, or even more, per person.

Again, as with butter, the problem of increased consumption depends in no small measure on quality. The recent regulation made by the State Department of Markets requiring the grading of the product should be helpful.

The institution of the trade brand "Mello-Creme" by the Wisconsin Cheese Producers Federation is a step in the right direction. If the California Fruit Growers Exchange finds it advantageous to pay a million dollars to advertise the merits of "Sunkist" oranges to the American people, the dairy interests of Wisconsin can well consider whether they cannot take a leaf out of the experience of this cooperative enterprise to develop more thoroughly their business.

The use of domestic-made "foreign cheese types" has been greatly stimulated during and since the war. The United States used to import from 18 to 20 million pounds of Swiss cheese yearly; in 1921 only a little more than 2 million pounds were imported. The substitution during the war of the domestic for the imported product has revealed the fact to the American consumer that he was not so dependent upon the imported product as he thought he was for quality of product.

Condensed milk. The situation with reference to this type of dairy product is in a more unsettled and uncertain position than that of any other outlet for milk. Prior to the war the exports of condensed milk were practically negligible, but in 1918, 41 per cent of the nation's production went abroad, an aggregate of over 830,000,000 pounds. Great Britain took substantially one-half of this amount in 1919. In 1920 a tremendous drop in exports occurred, falling to about one-fourth of our total production. The enormous expansion which occurred in this business as the result of the war has left the industry overextended. Plant capacity has been increased so much that it is fully 25 per cent more than the business needs of the industry now require. Readjustment consequently must take place; but in this process Wisconsin is rather fortunately situated, although the business here will have to be deflated to a material degree.

In determining the costs of production, condenseries located in the fluid milk sections find their costs of raw material considerably higher on the average than those factories which are located where they compete with butter or cheese production. Thus, the product manufactured in New York state and the seaboard is generally put into the can at a higher cost than that of the Mississippi valley or the Pacific Northwest. Of course, the eastern manufacturer has an obvious advantage in the matter of freight, but this often fails to overcome the difference in cost of raw material.

While a large number of our Wisconsin condenseries are located in the southern and eastern part of the state, where they are now competing more and more with the city milk supplies of Chicago and Milwaukee, an increasing number are developing in the western and upper parts of the state, outside of the fluid milk zone, where competition for milk is with cheese or butter factories.

Many of the condenseries that were started in the state during the war were new companies with no market brands or recognized merit. Their product was sold for foreign delivery or jobbed under special labels in chain or department stores. With the cessation of foreign demand, such concerns found increasing difficulty in disposing of their product, as the domestic trade naturally prefers a familiar brand. Obviously such enterprises suffer first and most severely in the process of readjustment, but the loss is ultimately reflected back to the farmer through a reduction in the price paid for the raw material, milk.

So far as future trade with Europe is concerned, it is problematical how much of this can be held. Much of the product exported for 1922, up to date, has been for "relief" purpose, going to Russia and Germany. Production in Europe is being gradually restored, and the Australian and New Zealand product is proving a formidable competitor to American goods from the standpoint of price. Up to the time of the war most of the canned milk used in Europe was the sweetened condensed product. The introduction of the evaporated milk is meeting with increasing favor in Europe, and it is, of course, possible that this demand may open up a new outlet. As soon, however, as this becomes a factor of moment the demand for this type will undoubtedly be met by our competitors.

THE MENACE OF "FILLED" MILK

The condensed milk business is now being subjected to another disturbing element and that is the menace of "filled" milk. The withdrawal of the natural milk fat, which during the winter was bringing 30 cents to 40 cents a pound, and its replacement with a tropical vegetable fat, cocoanut oil, that could then be purchased at 7 cents or 8 cents a pound, has curtailed in no small degree the full use of milk for this manufactured dairy product. It is noteworthy that this intrinsically cheaper substitute was customarily retailed to the consumer at nearly the same price as was asked for the standard condensed or evaporated milk. In 1919 the total production of filled milk in America was only 14,000,000 pounds. In 1920 it rose to 85,000,000 pounds, and about one-half (42,373,000 pounds) of this was made in Wisconsin and sold to the ultimate consumer under the guise of the standard evaporated product. The total butterfat production of 20,000 dairy cows, or over one-half of the annual increase of our entire dairy stock, was replaced in this state alone by these vegetable oils, that lack completely the growth-stimulating vitamines that are so essential to the proper development of the human body. Wisconsin has taken the necessary legal step along with ten other states to remove this menace to its dairy business by the passage of laws prohibiting the manufacture and sale of a product that reaches the consumer generally as a fraudulent food product. It is a pertinent question for America to ask itself whether it wants to build up the palm oil industry of the tropics, "where food falls from the trees," to the detriment of the dairy industry of the temperate zone with its steady employment and substantial homes. We could open our gates to the flood of orientals with their low living standards and thus secure cheap labor for the industries, but, as a nation, we realize that there are some things to consider in the welfare of a people other than debasing the working standards to the lowest living point.

Dried milks. This business, now in its infancy, is undoubtedly destined to play a role of considerable importance in the dairying of the future. Dried or powdered milks are now used mainly by bakers and candy, chocolate, and ice cream manufacturers, but in the not distant future it seems likely that this product will compete favorably with condensed and evaporated milk, if not city milk supplies. Within the past two years the production of dried milk in the United States has developed from 35 to 50 million pounds. At the present time there are three patents for the manufacture of dried or powdered milk. Two of these expire in the next few years. The possibility of producing a milk that can be shipped in dry form, thus eliminating the freight on the transportation of water; a product that can be stored and that can be processed at points of minimum production costs, opens a new outlet for the use of milk that is undoubtedly destined for rapid growth.

ELIMINATE LOW PRODUCERS

The average production per dairy animal in Wisconsin is almost 5,000 pounds of milk a year, making 190 pounds of butter fat instead of 150, the average of the United States. With 3,000 Wisconsin farmers in 147 different cow-testing associations testing the quality of the production of over 50,000 animals, and discarding this last year over 5 per cent of those animals; with 48 of these cow-testing associations in which every male animal is purebred rather than a scrub or inferior in quality; with the elimination of disease, which it has been possible to bring about here in Wisconsin so that now whole counties are entirely free from the scourge of tuberculosis—it is obvious that Wisconsin is in a position to face the competition of the future better than any other state in the nation.

The work of continued improvement will have to be pushed harder than ever as prices decline—better animals, better feeding methods, better care, elimination of all possible losses in the production of milk. Then, too, the leaks that now occur in the manufacturing processes must be cut out or greatly reduced. These are "the little foxes that destroy the vines," and eat up the profits. Take this recent experience of two Swiss factories in Green county. In one factory the milk brought the factory patrons 60 cents per 100 pounds because the quality of the cheese was so poor. Most of it developed a putrefactive fermentation, the so-called "stinker cheese." Within a mile from this factory was another factory which was turning out an extra fine product, bringing its farmer owners $3 a hundred for their milk.

It is necessary to overcome just such leaks as this to convert a serious loss into a profit. A well-established industry, as is dairying, judiciously and intelligently handled, still offers the best field for Wisconsin endeavor. The gamble in this crop is infinitely less than would be the case in grain, fruit, or beef, under Wisconsin conditions.

LOWER PRODUCTION COSTS

Our past with its record of achievement is behind us; our future is before us. What success our dairymen will reap in the coming decades will depend very largely upon how they profit from the lessons of the past. This one thing is, however, a sound conclusion:

A good dairyman can yet make more money with butter at 30 cents to 35 cents per pound, made from our bred-and-fed-for-production cows that are free from disease and are well cared for, than a scrub farmer can with poor animals and butter at 50 cents per pound. On the basis of this statement rests securely the future of Wisconsin's greatest agricultural industry.

"For fifty years a dairy state,
Let's plan for fifty more."

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September, 1922

Fifty Years of Dairy Progress

COMPETITION

and Plans for Fifty More

EXTENSION SERVICE OF THE
COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN
MADISON

Doctor Taylor, through his extended experience in Europe prior to our entering the war, as a representative of the State Department in Germany, and later, as a member of the American Food Administration and the War Trade Board, has been in a unique position to observe the dietary troubles that have menaced Europe through the lack of milk. His sincere belief in the necessity for maintaining American agriculture on a basis that will not endanger the adequacy of our milk supplies, with the consequent deterioration of the health of the nation, has led him to study critically the relation between vegetal and animal fats, as produced in the tropics, and under our more temperate solar energy.

We have considered it a matter of national concern whether we maintain American standards of living, by restricting the introduction of cheap Oriental labor with its consequent lower standards of life. This analysis raises a cognate question whether the cheap cocoanuts of the tropics, that nature grows so lavishly that they may be had for the gathering, are to displace the dairy cow that converts the grain and grass grown on American soil, because the tropical fats can be furnished at a lower cost of production. If the higher labor cost of an American standard of living carries with it something else that is worth while for America to preserve, may not the diversified American farm, the fertility of which has been kept unimpaired or even increased through the restorative balance of livestock and dairying, be worth something to the America of the future? The suggestive thoughts of Doctor Taylor in this address will help us more wisely to solve this problem.

H. L. Russell.

The Competitive Menace of the Tropics

ALONZO ENGLEBERT TAYLOR*

FOOD RESEARCH INSTITUTE, STANFORD UNIVERSITY, CALIFORNIA

WE ARE PRONE TO SEEK in the backwash from the war the causes of all economic difficulties. It is incumbent on the American man of affairs—be he farmer, manufacturer or distributor—to study his commodity more and Europe less. Disorganization resulting from the war has naturally intensified ineconomies in services and commodities. The backwash of the war will subside, but ineconomies will persist. The farmer needs to study his affairs intensively and extensively, with the best available methods of analysis.

One pre-war condition, intensified by the war, that confronts the majority of American farmers is the competition between vegetal fat and animal fat. In the ultimate analysis, it is competition between vegetal fat of the tropics and starch of the temperate zone. It is the purpose of the following presentation to formulate an objective statement of the situation and the problems that grow out of it.

Tropical oil seeds began coming into Europe in large volume some twenty years ago. The pressure of the European feeding yards on the grain fields of that continent stimulated search for concentrates. Then oil seeds appeared as competitors of the feed grains of the western hemisphere. The first effect was to furnish a cheap feed protein. The second effect was to furnish a cheap food fat. Cotton seed, peanut, soya, palm kernel and cocoanut became freely available to Europe. They supplemented or replaced grain more and more, and this resulted in appreciable cheapening of the production of animals in western Europe.

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Our agriculture has passed out of the extractive period of the frontier state and entered upon the domain of diversification. From now on seed selection, elimination of waste, prevention of parasitic disease, perfection of crop rotation, use of fertilizers and the employment of improved machinery must be relied on to supplant expansion in acreage. Increase in land values and other contributing factors tend to make the cost of production of feeding stuffs in this country as expensive as in Europe. The cost of production of cereals is also rising rapidly in western Canada, Australia and Argentine. Increased land values, higher capital charges and the need to make the operations of farming pay their own way without expectations of large unearned increments combine to elevate the cost of grains. The increased cost of production of cereals applied to bread has a direct effect upon the cost of the diet; it has a double effect when the cereals are converted into animal products. The purpose of conversion of cereals into animals is two-fold: to form protein (flesh) and to produce fat. The competition of tropical oil seeds impinges on both and represents a counter to the current practice of agriculture in the temperate zone.

Cheap oil seed lands are freely available in tropics and subtropics. These lands, largely in colonies, are really in the frontier stage. The labor needed to harvest the seeds is primitive and still in the stage of exploitation. In some localities the cultivation of oil seeds has developed to the plantation stage. Collection of the seeds is largely a question of transportation. Cotton seed, soya and peanut in the tropics or orient occupy a position midway between tropical palm and cocoanut and the oil seeds of the temperate zone. In the temperate zone, vegetable fats are grown in linseed, peanut, cotton seed, maize, soya, sesame, rape, sunflower and olive. The vegetable fats of the tropical zone are grown in cocoanut, palm, soya, peanut and cotton seed.

The cost of production of the oil seeds that are more or less common to both areas is much lower in the tropics than in the temperate zone. This is attributable to the greater intensity of solar energy in the tropics. The oil seeds produced only in the tropics (in particular the cocoanut) have the lowest cost of production. The peanut in the United States is an annual, requiring intensive cultivation. The cocoanut is a tree of hardy habits, long life, relatively free of disease and subject to few disruptions outside of drought and storm. The labor required in the cultivation of oil seeds in the temperate zone is relatively high priced; that in the tropics cheap. The cultivation of the soya and peanut in the Orient, although occurring in the temperate zone, is accomplished at low labor cost.

The production of vegetable oils in the tropics is really in its infancy. Cocoa, palm, peanut and soya are grown largely in the colonies of Great Britain, France, Belgium and The Netherlands. These countries have motives of national economy for development of colonies and must endeavor to sell the oil seeds to us as export items in their unbalanced trades. In the Philippines also are now some eighty million cocoanut trees, half in bearing. Soya represents one-fourth of the exports of China. As a direct producer of vegetable fat, therefore, the tropics can underbid the temperate zone heavily. This is equally true of feed protein. In maize, barley, peanut or cotton seed in the United States we cannot produce feed protein as cheaply as it can be produced in cocoanut, peanut and soya in the tropics. The gist of the situation is that the occidental temperate zone can import vegetable protein and fat from the tropics cheaper than it can produce them.

The pressure becomes accentuated when the production of animal fat is considered. Starch is first secured in grains and this then converted into fat in cattle and hogs. The solar energy in the tropics is more effective in fat production than is the solar energy in the temperate zone in starch production. In addition, animals are inefficient converters of starch into fat. The maintenance requirements of the animal are a heavy loss. Consider the feed required to bring pigs and steers to growth. From a pig of ten months, 25 per cent of the feed protein may be recovered in the carcass as flesh and 35 per cent of the feed starch as fat. From a steer of 18 months, 20 per cent of the feed protein may be recovered in flesh and 14 per cent of the carbohydrate as fat. These are top-notch figures. The usual returns from feeding operations are much lower. With cattle, returns are often as low as 10 per cent. These animals must be maintained on high-priced land, cared for with expensive labor. The result is that tropical vegetable oils at the site of production are much cheaper than animal fats in western Europe or the United States; even when the costs of transport and wastage are added to the cost of production of the tropical fats, the price of the vegetable oil in the markets of the countries of the temperate zone is still far below that of domestic animal fats. This natural cheapness of tropical oils is re-enforced by the fact that they arise by mass production, while animal fats in the temperate zone are the outturn of individual farmers.

We must recall that fats are the prime products of tropical lowlands. Of the cereals, only rice and millet do well. Domesticated animals do not thrive. The tropical lowlands are poor meat producers, only moderate starch producers, but heavy oil producers. The temperate zone and tropical highlands are prime producers of cereals. During the past ten years production of corn and oil seeds has been growing apace. Corn has now passed four billion bushels, three-fourths in the United States. The commercial production of oil seeds is growing, but is not measurable. During the three years before the war, the average vegetable oil in the world's export trade, expressed and in seeds, was about two million tons.

Fats have four uses: on the dining table; in the kitchen; in the bakery; and in a group of important technical processes. All are important and differ mainly in price levels. Fats are employed in soap making, in the tinning of steel sheets, in the manufacture of yarn and cloth, in the dressing of leather, in the fabrication of linoleum and other coverings, in the preparation of paints, varnishes, waterproofing and ink, in toilet preparations, as lubricants, and to some extent as an illuminant. At every point the competition of tropical fat with fat of domestic production is keenly felt. Every fat is salable on the basis of content of fatty acid and glycerine.

Fats are mixtures of the glycerides of oleic, palmitic and stearic acids. The different natural fats are different mixtures of these glycerides. Tallow has a high melting point, lard a medium and peanut, cottonseed and other oils a low melting point. Tristearin and tripalmitin are glycerides of saturated fatty acids; triolein is a glyceride of an unsaturated fatty acid.

By combining different fats the technical chemist is able to imitate any natural fat. It is possible to prepare a series of fats that progress regularly from fluid vegetable oils up to the hardest fats, such as tallow. Texture, spreading qualities and melting point are determined almost at will.

One may also convert unsaturated or liquid fats into saturated or hard fats by a process called hydrogenation. This is done by heating the fat with hydrogen in the presence of finely divided nickel. The saturated fatty acid thus produced is identical with that occurring in nature. This raises the melting point, causing an oil to become hardened into a soft fat, and a soft fat into a hard fat. The chemist can carry the process to any desired point. The combination of hydrogenation with mixing natural fats enables the hands of the technical chemist to compound fats to meet the most diverse specifications.

Vegetable oils are readily refined, clarified, bleached, neutralized, decolorized and deodorized. Removing the odors and the tastes is done by blowing through the mixture superheated steam or hydrogen.

In order to analyze how the competition of the vegetal fats is exerted, one must visualize the marketing of animal products. Cattle leave the packing house as dressed beef, cured meat, tallow, hide, bones, blood and a series of by-products. Each of these meets its own competitors in the market. The sale price of the carcass is a composite of the individual sales. If the price of any one fraction be reduced by competition, the price of one or more of the other fractions will be raised, the profits of the packer will be diminished, or the price of the animal on the hoof will be lowered. If the price of one of the fractions be increased, the price of one or several of the other parts may be reduced, the profits of the packer enlarged, or the price of the animal on the hoof increased. In 1921, for the first time in the records of the modern packing house, the dressed beef carcass has sold for a figure in excess of the price of the live animal. This has been due in large part to decline in prices of by-products, of which fat is one.

Beef is mostly consumed fresh, little is cured. Beef tallow has but limited uses as a food stuff. It is used in sausage, puddings and mincemeat; some is mixed directly with vegetable oil to form a cooking compound. Tallow under pressure separates into oleostearin and oleo oil; the stearin goes into lard substitute, the oil into oleomargarine. Considerable tallow is employed in the dressing of leather and as a lubricant. The largest amount goes into soap stock, where, however, it is being supplanted by hydrogenated cottonseed oil.

In the case of hogs there is a similar division of products. The animal leaves the packing house mostly as fresh meat, cured meat, lard and by-products. Of the carcass weight of the medium-sized American hog, about 37 per cent is cured ham, bacon and shoulder; 21 per cent is fresh meat; and 27 per cent lard and fat parts. If the pig be younger or smaller, the proportion of lean is increased; if larger and older, the proportion of fat is increased. Some of the fat of hog goes into technical uses, but most of it is employed as cooking fat. The sales price of the animal is a composite. Anything that lowers the price of one fraction will increase the price of one or several of the other fractions, reduce the profits of the packing house or depress the price of the animals on the hoof.

There are two kinds of packing house lard: kettle-rendered and prime steam-rendered lard. Steam-rendered lard is about 85 per cent of the total packing house lard. Of kettle-rendered lard there are two kinds: one secured at about 130° F., known as neutral lard and used largely in oleomargarine; the second rendered at about 250° F., that enters into trade. The inspected packing houses produce over half the market lard; the remainder, coming from local producers, is mostly kettle-rendered leaf lard. When lard is pressed, it separates into a solid fraction, a stearin, and a fluid fraction, lard oil. The stearin is used as a hardening component. Lard oil is employed as lubricant, illuminant, cutting fluid, and quenching bath.

Cottonseed oil is secured to commercial advantage only from certain grades of seed; and varies considerably in different localities. It serves every conceivable use to which fat can be put. It is the base of the older type of oleomargarine. A billion pounds of cottonseed oil go annually into lard substitutes.

Peanut oil is being produced in large amounts in our country and the plant is coming into favor in the Mediterranean countries. Huge amounts of peanuts are grown in Asia and are shipped out to be crushed in importing countries. Peanut oil makes a high-grade table and cooking oil and is used largely in lard substitutes and margarine. During the war peanut oil replaced Spanish olive oil in the woolen industry in this country.

Crude corn oil is employed in many industrial uses; the refined oil goes into table oil, cooking oil, lard substitutes and margarine.

Olive oil of higher grade is used almost exclusively as table oil and cooking oil. Olive oil of the lower grade is widely employed in spinning and weaving and in soap making.

Cocoanut oil requires no hydrogenation, as it is low in triolein, which has a low melting point. It is widely used in soaps, particularly in marine soaps, in cosmetics, cakes, confectionery, in margarine and in filled milk. Copra, which is the sun-dried white meat of the cocoanut, has a low freight rate and, as it contains 60 per cent of fat, the freight cost of cocoanut oil is low.

Palm and palm kernel oil are similar to cocoanut oil. Palm oil is employed largely in tin plating. Just as it replaced tallow in the tin mill, so it is now being threatened by hydrogenated cottonseed oil. Palm oil is employed largely in soap, shaving cream, margarine, cakes and confectionery.

Soya oil, coming from Asia, stands highest on our import list. The soya bean grows in the United States and in Europe, but has a different status than in Asia, because there the protein is used for human food, while here it is used largely for animal feed. It is used in lard substitutes and margarine. To a larger extent it is employed as a semi-drying oil in paints, and in soap making.

Cheap tropical oils do not compete severely with beef fat for the simple reason that the price of tallow is already down to the level of an industrial fat. But in the case of oleo stearin and oleo oil, competition is severely felt and these are being crowded out of the margarine factory by vegetable oils. In the case of the hog, however, the situation is different. Lard is one of the prime products of the pig. Lard substitute can be compounded closely to possess the consistency, melting point, boiling point and general attributes of lard. These vegetable cooking fats can be produced profitably at low cost. Lard substitutes of the older type contained lard, oleo stearin, tallow and cottonseed oil. More recently, hydrogenated vegetable oils have been widely employed. Some lard compounds are mixtures of animal and vegetable fats, others consist exclusively of vegetable oils. The white color of lard is imitated in the manufacture of lard substitutes by beating air into the mixture. Color and texture effectively simulate the qualities that make lard a favorite cooking and baking fat in Anglo-Saxon, Teutonic and Scandinavian countries. Lard substitutes lack the pork taste.

With each year lard becomes a less profitable fraction of the carcass. This means that the prices of bacon and ham must be increased, the profits of the packer reduced or the price of hogs depressed. The larger the percentage of fat in the animal, the more severely is the competition of the vegetable oil felt. The meat packers have been driven into the field of vegetable oils. The five large meat packers refine one-third the cottonseed oil and make nearly half the lard substitute. When the factories prepare from vegetable oil a cooking fat that behaves like lard, at a lower cost, this merely means that the production of the fat by solar energy in the tropics is more efficient than the production of starch by solar energy in the temperate zone and the conversion of this starch into lard in the body of the pig.

We are heavy exporters of lard, indeed we may say our export of lard maintains the domestic price. We produce more lard substitute than packing house lard. Just as Denmark consumes margarine and exports butter, we consume lard substitutes and export lard. North Europeans naturally prefer lard to the substitutes. They like the trace of pork taste, but price considerations may be expected to apply there as never before. We may, therefore, expect lard substitutes, made here or in Europe, to undermine our lard trade there.

To a considerable extent the price of the fatty by-products is of importance in the composite price. Indeed, it is sometimes the active variant. In this direction the technical chemist is in position to make the competition of the vegetable oils severely felt. There are few technical uses of animal fats in which the vegetable fats cannot be successfully used as substitutes. It is largely a question of price. This is especially true of soap. All fat is grist to the soap mill. That is one reason why soap making is a highly speculative business.

The competition of the vegetable oils is not restricted to the fat or slaughtered animals. The dairy is equally involved. The butter substitutes attained the world over a forced vogue during the war. Margarines are spreading fats composed of mixtures of animal and vegetable fats or of vegetable fats alone, having the general consistency of butter. Margarine does not possess the taste, odor or color of butter, when compounded directly from the component fats, which is one method of preparing it. If, however, the component fats are churned in skimmed milk or buttermilk, the product displays a trace of the odor and taste of butter. Oleomargarine must be made under governmental inspection, while vegetal margarine is free in manufacture, though both pay the tax.

Vegetable margarines have naturally no color unless yellow palm oil is employed. Margarine has the same fuel value as butter, the same traces of salts. Because it is free of protein it keeps well. It is usually a sanitary product, because manufactured in efficient plants. It is low or deficient in the fat-soluble vitamine. Margarine is always cheaper than butter, even at the flood season of butter production. The middle class of England practically abandoned butter during the war. To them margarine represented economy. Imported butter having fallen greatly in price, British consumption of margarine is falling to the pre-war level. The present margarine consumption in Germany is 19 pounds per capita per year.

In the trade, margarine is the term applied to a vegetable product, while oleomargarine contains animal fats. The law classifies them all as oleomargarines for purpose of taxation. A good formula for vegetable margarine is five parts cocoanut oil and half as much each of peanut oil and "cultured" milk or milk soured by means of a "starter." After churning, the margarine is allowed to "ripen" for a couple of days and then salted. In the United States all margarines are manufactured by churning. Such margarines develop a little of the butter flavor on cooking. In Europe some margarines are compounded directly. Margarines, like butter, are emulsions, containing approximately 15 per cent of water.

Filled butter would be the correct term to apply to the early oleomargarines. There was a time when oleomargarines consisted of more than half butter; later of 25 per cent butter; the modern butter substitutes contain no butter at all. Within recent years, however, a new form of filled butter has made a cautious appearance. This is filled unsalted butter. Anyone who will take one part of good butter, wash it free of salt and add a half part of sweet cream and a half part of cocoanut oil and mix carefully will learn how admirable a product, from the standpoint of taste and appearance, may be thus produced. To what extent such filled butters are employed in hotels and pastry shops I have no way of knowing.

While margarine can be produced cheaper than standard butter, within recent years new methods of producing butter have been developed by which the cost of competitive butter is considerably reduced. Broadly considered, there are five kinds of market butter: (1) sweet cream, unsalted butter; (2) standard (local) creamery butter; (3) centralized butter, made as renovated product; (4) centralizer butter made as prime product; and (5) renovated butter. Today centralizer butter made as prime product apparently makes the market price and seems to be rapidly replacing creamery butter of the older type. The manufacture of butter by the centralizer method is efficient and produces a more uniform product than with the older creamery method. Margarines compete with all butters except sweet butter; it is a question of price. Uncolored margarine stands at a disadvantage.

Price differences between different butter grades are clear-cut on the produce market and with jobbers. To a surprising extent they fade in the hands of the retailer. Few housewives are judges of butter grades in the trade sense. The price of milk and the price of butter react on each other. The consumer of fluid milk in cities has to outbid the butter-fat price.

European countries also have developed margarine fabrication to a great extent. Denmark is the classical illustration. Denmark raises a certain amount of feed grain, especially barley, for young animals; she raises a large amount of fodder roots. She imports oil seeds as concentrates. The seed meal she feeds with hay and fodder roots to cows. Butter is churned from the cream. The vegetable oils are introduced into the buttermilk and a margarine churned from that. The final buttermilk is fed to pigs with barley, primarily for the production of bacon. Bacon and butter are the sales products and go largely into export. The margarine is consumed at home, though also exported. The entire industry thus rotates around the oil seeds. The competition of vegetable oil with butter here is not merely domestic, but operates through importations, because European butter that enters this country does so as the result of importation of vegetable oil in Europe. Danish butter comes here because oil seed goes there.

Filled creams are of three kinds, designed for use as whipping cream, in pastry and confections and employed as ice cream. In each of these directions the product may be cheapened for the manufacturer. A legal check has been placed upon the use of filled cream in ice cream. It is difficult to apply a legal check to the use of filled cream in cakes and in confections. Filled cream sold for whipping cream can be controlled as in the case of ice cream. In Europe in particular a great many creams employed in pastries and confections are made of sweet butter. The ability of the technical chemist to produce a brand of odorless, tasteless vegetable fat of particular texture and behavior enables the pastry maker to produce attractive wares by the partial substitution of butter and at great profit.

Filled cheese appeared over forty years ago and was extensively produced in the eighties. Substitute fat was added to skimmed milk and the mixture used in the manufacture of cheese. It was an inferior product. The milk was usually unclean. The oleo oil added was not well refined. The factory possessed no homogenizer to secure adequate mixing of the components. It was prepared largely for the export trade. It did not age well on reaching the foreign market and it oozed fat at warm temperatures. It was regarded in the foreign markets as a fraudulent adulteration and did a great deal to injure the reputation of American cheese abroad at that time. It has fallen entirely into disrepute and, so far as I am aware, is not being manufactured here today. With clean methods, the use of refined oil, the homogenizer and the employment of specific cultures, filled cheese could be so made today as to imitate the natural article completely, except to the analyst.

The newest form of competition of vegetable oil is in filled milk. Filled milk consists of sweet skimmed milk to which 6 per cent of cocoanut oil has been added and the whole brought into homogeneous mixture. Filled milk contains the proteins, sugar, salts, flavors and water-soluble vitamines of milk. It lacks the fat-soluble vitamine which is so characteristic of natural milk. It has as much or more fat, but a different fat, though equal in fuel value to butter fat. There is a large percentage of milk devoted to the manufacture of butter. Before the advent of filled milk, skimmed milk was largely fed to animals or thrown away. The filled milk conserves the milk proteins, by placing on the market a substitute milk without the fat-soluble vitamine. Filled milk can be prepared, condensed and marketed at a far lower price than genuine milk.

Filled milk and margarine lower the price levels of the ordinary grades of fluid milk and butter. They have no influence on the price of certified milk or unsalted butter. But since certified milk and unsalted butter make up the lesser fraction of the total production of milk and butter, the influence of the competition of margarine and filled milk is felt throughout the entire dairying industry. By competing with evaporated milk, filled milk restricts the market for natural milk and evaporated milk. Filled milk competes more directly with evaporated milk than with fluid milk in the city market.

The competition extends farther. In those countries in the temperate zone that produce and use vegetable oils as table oils or cooking fats, the tropical oils compete directly. We produce in this country little olive oil, but a great deal of cottonseed, peanut and maize oil of excellent grade. These are gradually acquiring a place in American esteem, competing with our animal fats and olive oil, replacing imported olive oil.

Anything that depresses the price of cottonseed oil exerts a widespread influence. The cotton grower sells his product as lint, linters, oil, meal and hulls. Each of these products has its own competitors in trade. A reduction of two or three cents a pound in the price of cottonseed oil, by competition with imported tropical oil, is almost as severely felt as a comparable reduction in the price of cotton. There is in this country little competition between tropical oils and our vegetable oils as table oils. In southern Europe, however, a different situation prevails. There the table and cooking oil is largely olive oil. Oil of the sunflower, rape, sesame, and other seeds that are grown in Europe offer little competition. But cottonseed and peanut oil, imported from this country or from the tropics, give serious competition. These oils lack the peculiar flavor of olive oil and must sell in southern Europe at a lower price in order to attract the trade. Southern Europe is a large exporter of olive oil, and an importer of cottonseed oil. The export is a high-priced product; the import low priced. With increasing importation, the tendency is to drive down the price of olive oil to such a point as to disturb the normal agriculture of southern Europe. France has a particular problem, because the development of her colonies develops a competitor for her olive trees.

In northern Europe practically no table oil is grown. Imported oil may be the olive oil of southern Europe or the cottonseed, peanut and vegetable oils of the tropics and Orient. The people of northern Europe do not take kindly to the use of a fluid oil in cooking or on the table. They prefer the more solid hydrogenated oils. Under these circumstances the use of lard substitutes is attaining a foothold. Lard is still preferred.

Vegetal oils, in order to compete more successfully with animal fats, have found it advantageous to take on the physical appearances of natural animal fats. The baker will shorten with fluid oil. But the housewife wants the oil made to look like lard. Margarine is made to look like butter and cocoanut oil is hidden in the physical appearance of milk. There is much national psychology in this. The women of Italy will use cottonseed oil in the natural state. But the women of northern Europe want lard substitutes to look like lard. The vegetal oils trade, in part, on the appearances of animal fats and are found acceptable only when they imitate them.

This sketches the general situation. It may be taken for granted that the cost of production of tropical oils will not rise to the plane of the cost of production of vegetable oils or animal fats in the temperate zone. On a pure price basis, the tropical oils have a wide margin in their favor. This margin represents the constant pressure that is being felt through Europe and the United States. This pressure is not merely of today, but also of tomorrow and probably in increasing intensity.

The competition of margarine and filled milk is felt wherever dairy interests are developed and intensified. The pressure of the lard substitutes and of the industrial vegetable oils is felt particularly in the corn belt. Not a little of the stored-up corn of Iowa is held back by the pressure of tropical fat. One of the reasons why the farmer has not found the raising of cattle and hogs remunerative is because the low price of tropical vegetable oils has reduced the price of the fat fraction of the cattle and hogs.

Broadly considered, three fundamental questions are presented. Does widespread and far-reaching substitution of animal fats by vegetable fats jeopardize the nutrition of the masses? Does extensive substitution of vegetable fats constitute a jeopardy or a challenge to the present type of American agriculture? What consequences for the general trade situation of the United States will flow from heavy and continuous importation of vegetable fats?

A number of technical questions connected with nutrition and agricultural practice must be determined before the situation can be regarded as clarified:

(a) What amount of fat-soluble vitamine must be provided in the diet of the people in the shape of milk and to what extent may this vitamine be provided for children in fruits and leaf vegetables?

(b) To what extent must balanced proteins and salts be provided for growing children and what proportion of these ought to be administered in the form of milk?

(c) What disorganization in agricultural practice is to be anticipated, if natural fat-soluble vitamine, balanced protein and salts of the milk were to be replaced, from one direction or another, in the child's diet?

Once these data are established, the policy to be adopted will depend upon the national point of view. To a considerable extent any specific policy adopted will be a reflection of our conception of the relation of government to industry.

(1) Those who believe consistently in the *laissez faire* doctrine of free trade will regard the substitution of animal fats by vegetal fats, of domestic fats by tropical fats, as proper and desirable.

(2) To those who believe that the mixed diet of Europe and North America has been the determining element in physical stamina and intellectual outlook, as contrasted with those observed in Asia, the free trend toward vegetarianism is a menace. To those who believe that legislation represents a practicable method of directing national development, congressional action is called for in the maintenance of animal products in our diet. This was in general the tone displayed in the hearings on the Voigt filled milk bill, recently before Congress, contending that a high intake of dairy products is essential to maintenance of national vigor.

In illustration of the dependence of public health on milk, several mass experiments of the modern world are adduced.

(a) The diet of the Roumanian peasant consists largely of maize, milk and onions. It is a sufficient diet, when the milk is abundant. When the milk is reduced, deficiency diseases appear. Following the German invasion of 1916 the milk supply of the peasants was greatly reduced. The result was deterioration of health.

(b) Years ago it was pointed out that when the peasants of the upper Bavarian highlands, following the introduction of the centrifugal cream separator, sold their cream in place of consuming it, the nutrition of the group was reduced.

(c) The undernourishment in Poland, Czecho-Slovakia, Austria and Hungary during the last three years has been attributable more to lack of milk than to lack of total food. The efforts of the American Relief Administration were directed particularly toward contribution of milk and the result in restoration of child health has been out of all proportion to that which might have been expected from the energy as measured by the calories contained in the milk.

(d) Because it was more profitable to sell butter and consume margarine, large classes in Denmark within the last decade reduced greatly the consumption of dairy products. This resulted in subnutrition that finally was combated by rationing of milk to the classes involved.

(e) Beginning with 1917, the city workers of Germany suffered great reduction in milk, sometimes as much as three-fourths of the normal supply. Subnutrition appeared promptly and it seems clear that this subnutrition was more the result of deficiency in milk than of deficiency in calories. Indeed, the food shortage of Germany found expression in public unhealth in proportion to its influence on milk production.

(f) A very large experimental literature dealing with the growth of animals has made it certain that retardation of growth and deterioration of health occur as the result of restriction of fat-soluble vitamine and that a minimum of this substance is necessary in the diet otherwise perfect.

(g) Restriction of fat-soluble vitamine in animals and children results in diseases of the bones and teeth.

There is considerable subnutrition in the children of our cities and to a rather surprising extent it extends to smaller towns. It is contended by some that at the moment the young urban generation is showing the first signs of deterioration through change in the national diet, expressing itself particularly in reduction of dairy products.

The consumer class, especially in the cities, has rights in two directions. On the one hand, a balanced and adequate diet must be assured. This means, for the Caucasian, a certain minimum of animal protein, fat-soluble vitamine and mineral salts. Milk meets these indications. The question remains to fix the safe margin. On the other hand, the urban working classes have the right to buy mere calories, fuel, on the basis of price. How much milk is needed as carrier of vitamine, balanced protein and salts? How much vegetal oil is permissible as mere fuel? The answer will be different for children and adults. But children require protection and a good margin of safety. Better surveys of child nutrition are needed than are now available in order to mark a line of policy. But in the meantime, society should err in favor of children rather than against them.

A large amount of fat-soluble vitamine now goes to waste in the viscera of cattle and fish that goes into tankage, used for feed or fertilizer. The fat of these materials, refined, decolorized, and deodorized, would represent a large source of fat-soluble vitamine. It is to be anticipated that these fats will sooner or later be preserved and constitute an addition to the supply of fat-soluble vitamine available outside of milk. A filled milk containing the normal amount of fat-soluble vitamine could not be condemned on health grounds.

Skimmed milk contains the valuable proteins of milk. For years students of home economics have sought ways of utilization of skimmed milk in the human diet. These proteins rank higher than cereal proteins. With the possible exception of wheat, they are better than the proteins of muscular tissue. In the judgment of the writer, the best utilization of skimmed milk lies in breadmaking, to which it contributes sugar as well as protein, any fat being available for shortening.

Assuming this established, those who believe that regulation of the diet and, consequent thereto, control of the manufacture and purveying of food stuffs, is a function of legislation (national, state or municipal), support such legislation on the general ground that it may be possible now to stop the undermining of the national health, whereas later it would be more difficult to resuscitate it. Under such a view it is regarded as proper to forbid foods that are not in themselves directly injurious, but are inferior in a biological sense, in order to maintain and restore the use of other foods that are superior in that same sense. This is, of course, outright paternalism in government and is the direct antithesis of the *laissez faire* doctrine that a nation should buy its food where it is cheapest.

(3) Those who believe in restriction of fraud in foodstuffs, essential and not merely literal, find ground for legal action in the general premises along this line. The state of Iowa took legal action against a firm engaged in the manufacture of ice cream on the ground that the product did not represent a frozen dairy cream and was, therefore, fraudulent. The imitation was perfect except to the analyst. This test case reached the United States Supreme Court, combined with a case from Pennsylvania, and received a decision without dissenting opinion. The essential point in the argument concerned the interpretation to be placed upon the word "cream." It was contended for the state that "cream" meant "dairy cream" and therefore ice cream must include a certain amount of milk fat. It was contended for the manufacturers that ice cream meant a compound and a confection and did not necessarily suggest dairy cream. The Supreme Court adopted the view that "cream" carried the meaning "dairy cream" and that whatever else ice cream might contain, it lay within proper police powers to say that it must contain a certain amount of milk fat. Under this decision the laws of various states fixing the amount of milk fat in ice cream at from 10 to 14 per cent seem definitely determined.

For many years the sale of skimmed milk has been prohibited or hedged about with restrictions. This was done to prevent fraud, it being held that the only way to stop the fraudulent sale of fluid skimmed milk was to prevent all sale except in bulk packages. The state of Ohio, possessing such a law of old standing, proceeded against the sale of filled milk. This was made a test case and carried to the Supreme Court of the United States. The essential point here again was the classification of the product "filled milk." The state contended that "filled milk" was "skimmed milk;" the manufacturer contended that "filled milk" was a compound. The manufacturer contended that specific labeling of composition prevented deception of the consumer. The state then contended that since a filled milk is a perfect imitation of natural milk, except to the analyst, fraudulent sale to the consumer and mistaken purchase by the consumer are inevitable.

The Court was divided. The majority opinion upheld the state of Ohio. It was accepted that "filled milk" is "skimmed milk." "It seems entirely clear that condensed skimmed milk is forbidden out and out, but if so the statute cannot be avoided by adding a small amount of cocoanut oil. We may assume that the product is improved by the addition, but the body of it still is condensed skimmed milk and this improvement consists merely in making the cheaper and forbidden food more like the dearer and better one and thus at the same time more available for a fraudulent substitute." The dissenting opinion, signed by three justices, was based largely upon the contrary notion that filled milk was not condensed milk, or skimmed milk, or milk at all, but a food compound and one not to be classified as milk, because condensed skimmed milk was one of the ingredients. One of the makers of a filled milk describes the product as a "cooking liquid, intended for the economical preparation of cooked and baked foods."

Under these decisions of the Supreme Court of the United States, it seems now to lie within the police power of any state to prohibit the sale of ice cream with less than a certain percentage of milk fat and of skimmed milk with or without the addition of substitute fats. These decisions would apply also to the sale of filled cheese. They would not apply to margarines, since these are food compounds and not filled butters.

(4) Those who believe in legislation for the development of the industries of the state find themselves in possession of a mass of precedents in this country for legislation designed to maintain the established type of agriculture. The theory of a diversified agriculture is regarded as established and this includes, for the soil and climate of the United States, a certain proportion of domesticated animals and of these a large proportion of dairy stock. Up to a certain point dairying and meat production are complementary, but beyond this point dairying expands at the expense of meat production and is more efficient. Legislation for the development of industrial symmetry has always proceeded, consciously or unconsciously, more or less upon the theory of equalization of production costs. Since 1894 tariff protection for equalization of production costs has represented the policy of the Republican party. The Underwood Tariff of 1913 expressed the principle of the Democratic party to the effect that tariff duties should be no higher than to enable foreign and do-

mestic products to compete. The differences between the two parties have almost been obliterated. Under such statements of policies, American agriculture now seeks for such legislation as will equalize the production costs between animal fat and vegetable oil, between milk fat and tropical substitutes. Two modes are available:

(a) Tariff on importation of vegetable oils. This might work effectively in European countries, but would not have the same action in this country, because we are large producers of cottonseed, peanut and corn oil. If, however, the tropical and oriental vegetable oils (including those of the Philippines) carried heavy import duties, this might have the effect of raising the price of domestic vegetable oils and lessening the competition with animal fats. But it might drive foreign oils to the European market, to the injury of European demand for our animal and vegetal fats. Import duties on vegetal fats are strenuously resisted by industrial users of fats, particularly by soap makers. Our soap consumption is about two and a half billion pounds annually. It is possible that free trade in inedible oils used in industries would not be inimical to the farmer.

(b) Imposition of tax. The present taxes on oleomargarine are an illustration in point. Such a tax might be fixed to represent the difference in cost of production between the competing substitute and the natural product. A tax on margarines and filled milk, to equalize the difference in cost of production of milk fat and vegetable oil, would have the same meaning in fact as a tariff on wool.

The broad formulation of the question is this: Do we desire unrestrained competition of vegetable oil with butter fat, cocoanut oil with milk fat, soya oil with hog fat? Do we plan to expose diversified American agriculture to unrestrained competition with vegetable oils; in the final analysis with tropical vegetable oils? What effects would be expected on consumers and on agriculture?

The practices of agriculture might be so modified as to minimize the competition with vegetable oils by feeding animals for flesh rather than for fat. Selection and breeding have resulted in types of hogs. The people of northern Europe in general breed the bacon hog. Thirty years ago the government of Canada conducted a campaign in favor of the bacon hog that had the result of practically transferring the swine industry of Canada to this basis. We more largely raise lard hogs, although the market demands have changed materially toward less fat in recent years.

If the corn belt would devote its attention to raising fewer lard hogs and more bacon pigs, it would feel the competition of lard substitutes less keenly. This would introduce certain alterations in agricultural practice. The central states would raise less corn and more barley and rye. In any event, if there were greater diversification in the swine industry, conditions in the corn belt would be ameliorated.

Changes in methods of feeding of cattle and hogs seem imperative. Leaders in agriculture in numerous states have been urging upon farmers the desirability and necessity of shifting from corn to other products. Corn raising requires definite crop rotation. The fact that in the central states like Iowa it must be rotated with oats brings a new difficulty, because with oat acreage maintained while the horse count falls, a glut of oats is almost inevitable. Feeding experiments have amply demonstrated that legumes, fodder roots, ensilage, and protein-rich forage plants fed with a minimum of grain, and preferably small grain, produces first-grade beef and pork. An acre of land produces many more calories of such feeding stuffs than when planted to corn. To a certain extent it ought to be practicable to change the type of animal, to switch from lard hog to bacon hog. It ought certainly to be feasible to feed the animals at lower cost. The bacon hog fits in well with the dairy cow and the changes in farming practice ought to be accomplished without marked dislocation.

One very important distinction is to be noted between importing oil seed protein and oil seed fat. The one is a raw material for agriculture, the other a raw material for manufacture and comparable to a product of agriculture. It is of great advantage to agriculture to import oil seed protein for feed. It is equivalent to the importation of Chili saltpeter. A ton of oil seed protein fed to a dairy herd will contribute to the soil nitrogen the equivalent of 1200 pounds of saltpeter. This was one reason why peasants in Europe preferred these concentrates to domestic grains in their feeding yards. With increasing impoverishment of our soils, the importation of protein concentrates becomes a matter of growing importance.

Why do we crush the oil seeds, use the expressed oil for food and the residue for protein feed, instead of feeding the unexpressed crushed oil seeds? Because the protein is invaluable as feed, while the vegetable oil is disadvantageous. When animals digest proteins, these are broken up into the component amido-acids and from these the several proteins of the flesh of the animals are built up. When fats are ingested, they are largely deposited unchanged. To feed dairy cows and hogs with vegetable oils means that the butter and lard will have a low melting point, i. e., softer fats. When an animal builds fat from carbohydrate, on the contrary, it forms the fat peculiar to the species. In finishing livestock, body fat formed from diet fat is specific to the diet, while body fat formed from carbohydrate is specific to the species. For example, swine grown largely on peanuts will produce a soft pork that commands a lower price in the packing industry. For these reasons the protein fraction of oil seeds is highly prized in animal husbandry, while the oil fraction is not desired.

Europe is a food importing country. The importation of large amounts of tropical and oriental fats is necessary there. Since Europe must import calories for energy, she ought to import them as cheaply as possible. The United States are not a food-importing nation. Our agriculture is still in excess of our domestic requirements. The importation of vegetable oils to replace animal fats represents the first substantial importation of food stuffs on the national price basis. It represents the first step in the ladder that Europe began to ascend in the period of industrialization after the Franco-Prussian War. It forecasts the first serious dependence of our country on imported calories. Such importation is not due to failing domestic production, but to cheaper production in warmer climates. We do not face a failing agriculture, we face the low price of foreign land, cheap labor and hotter sunshine. We face also the struggle between mass production in the tropics and individual operation on the American farm.

The following tables present figures reflecting the national position in animal and vegetable fats and the international position in trade in vegetable oils. The statistics of fats are in a very unsatisfactory condition. It was not until after the outbreak of the war that the Departments of Commerce and Agriculture really began to assemble data on the production of vegetable oils. The data are in an unsatisfactory condition because of overlapping between crude and refined oils and between industrial and dietary utilization. The table for production of commercial animal and vegetable oils has been prepared from official data and is believed approximately to represent the situation. Both edible and industrial fats are included. Imports and exports are, of course, accurately known. The difference between net exports and production is termed available for consumption rather than denominated as consumed, because the data on visible and invisible stocks are not properly reported.

TABLE I.—PRODUCTION, IMPORT, EXPORT, AND AVAILABLE AMOUNT OF COMMERCIAL DAIRY PRODUCTS* IN THE UNITED STATES, 1907-1921.

(Unit: Thousands of Pounds)

Year	Production	Import	Export	Net Export	Amount Available for Consumption
1907		35,172	14,416	20,756	
1908		34,055	19,315	14,740	
1909		39,213	6,576	32,637	
1910		45,176	18,688	26,488	
1911		46,452	37,249	9,203	
1912		49,805	26,926	22,879	
1913		59,316	22,346	36,970	
1914		62,678	30,556	32,122	
1915		40,463	157,073	116,610	
1916		29,192	300,466	271,274	
1917		7,641	489,297	481,656	
1918	2,934,977	20,122	625,825	605,703	2,329,274
1919	3,346,286	37,860	902,878	865,518	2,480,768
1920	2,967,943	77,204	451,279	374,075	2,593,868
1921	2,957,750	54,092	320,549	266,457	2,691,293

* Milk (condensed, evaporated, and dried), butter, and cheese.

TABLE II.—PRODUCTION, IMPORT, EXPORT, AND AVAILABLE AMOUNT OF COMMERCIAL ANIMAL FATS AND VEGETABLE OILS IN THE UNITED STATES, 1912-1921.

(Unit: Thousands of Pounds)

	Animal Fats[1]				Vegetable Oils[2]			
Year	Production	Import	Export	Amount Available for Consumption	Production	Import	Export	Amount Available for Consumption
1912	2,785,649	10,514	683,002	2,113,161	1,544,672	215,542	379,638	1,380,576
1914	2,948,165	22,697	562,063	2,408,799	1,925,178	226,158	233,757	1,917,579
1916	3,357,610	14,297	591,099	2,780,808	1,761,278	351,240	201,910	1,910,608
1917	2,946,336	80,260	439,172	2,587,424	1,756,380	564,692	137,120	2,183,952
1918	3,429,075	54,816	661,094	2,822,797	1,925,555	824,302	121,983	2,627,874
1919	3,420,356	22,355	949,040	2,493,671	2,110,085	778,532	381,211	2,507,406
1920	3,267,490	46,985	763,379	2,551,096	1,533,474	519,181	276,103	1,776,552
1921	3,772,882	17,271	1,075,410	2,714,743	1,534,765	282,045	276,920	1,539,890

[1] Includes butter fat, lard, neutral lard, lard oil, lard stearin, oleo oil, oleo stock, tallow, tallow oil, oleo stearin, and animal stearin.

[2] Includes cocoanut, corn, cottonseed, olive, palm, palm kernel, peanut, rapeseed, soybean, and vegetable stearin.

The table on international trade in vegetable oils is based upon the best available data of imports and exports of oil seeds and expressed oil, partly official, partly drawn from the reports of the International Institute of Agriculture. The figure for 1920 is partly a trade estimate. For convenience the figures are given in terms of expressed oil under the assumption that oil seeds imported in the different years contain an average amount of oil and that all imported oil seeds are subject to crushing. The figures in this table are only roughly approximate, but give an illustration of the general trend of international trade in vegetable oils, indicating the pre-war level, the decline during the war with scarcity of tonnage and the recovery to the pre-war level by the end of 1920.

TABLE III.—INTERNATIONAL TRADE IN VEGETABLE OIL (METRIC TONS).

1910	2,080,000	1916	1,540,000
1911	1,990,000	1917	1,370,000
1912	1,960,000	1918	1,220,000
1913	1,770,000	1919	1,760,000
1914	1,560,000	1920	1,920,000
1915	1,670,000		

CHICAGO PRICES OF VARIOUS ANIMAL AND VEGETABLE FATS IN CENTS PER POUND, THE THIRD WEEK IN JANUARY, 1922.

Grease, brown	4.5	to	4.75	Crude cocoanut oil	9	to	9.5
Prime packers' tallow	5		5.6	Prime steam rendered lard	9.5		9.75
Grease, white	6.5		7.25	Oleo oil	9.75		10
Tallow, loose	7		7.5	Refined soybean oil	10		10.25
Oleo stearin	7.25		7.5	Standard lard substitute	10.25		10.5
Crude cotton seed oil	7.25		7.75	Refined cocoanut oil	10.5		10.75
Palm oil	7.75		8	Refined peanut	10.75		11.25
Edible tallow	8		8.5	Standard oleomargarine	21	23	25
Refined cotton seed	8	8.5	8.75	Creamery butter	35	37	39
Palm kernel	8.5	to	8.75				
Crude soybean oil	8.75		9.25				

In order to illustrate the interchangeability of vegetal oils and fats, the demonstrated derivatives may be tabulated. The list includes only the principal oils and fats. The magnitudes of the several operations vary widely and fluctuate from season to season. Some of the derivatives proceed from residues or foots, others from unrefined oil or fat, others from refined oil or fat. The technical procedures are more or less intricate with different derivatives and these difficulties find expression in the price levels necessary to make a particular procedure available or unavailable.

PRODUCT	DERIVED FROM
Lard substitutes	Lard, cocoanut oil, soya oil, corn oil, cottonseed oil, oleo oil, animal stearin, vegetable stearin and peanut oil
Salad and cooking oils	Soya, corn, cottonseed, peanut and olive oils
Oleo-margarine	Neutral lard, oleo oil, animal stearin, cottonseed oil, corn oil, peanut oil and tallow
Margarine	Soya oil, corn, peanut, cottonseed and cocoanut oil
Animal stearin	Tallow and hog fat
Vegetable stearin	Peanut oil, cottonseed, corn oil and soya oil
Oleo oil	Tallow, hog fat, soya oil, corn oil, cottonseed oil and peanut oil
Neutral lard	Hog fat
Filled milk	Cocoanut oil
Soap	Fish oil, hog fat, tallow, soya oil, corn oil, cottonseed oil, peanut oil, olive oil, cocoanut oil and palm oil
Fats used in metal industries	Palm oil, palm kernel oil, soya, cottonseed oil, fish oil
Fats used as lubricants or quenching materials	Palm, palm kernel, soya oil, fish oil, lard, neutral lard and cottonseed oil
Fats used in textile industries	Olive oil, peanut oil, soya oil and cottonseed oil
Fats used in manufacture of inks, paints, rubber substitutes and leathers	Tallow, fish oil, cottonseed oil, soya and olive oil
Domestic products	Tallow, hog fat, fish oil, soya oil, corn oil, cottonseed oil, peanut oil and olive oil
Products from island possessions	Cocoanut oil
Imported products	Cottonseed oil, soya oil, peanut oil, tallow, cocoanut oil, palm oil, palm kernel oil and olive oil

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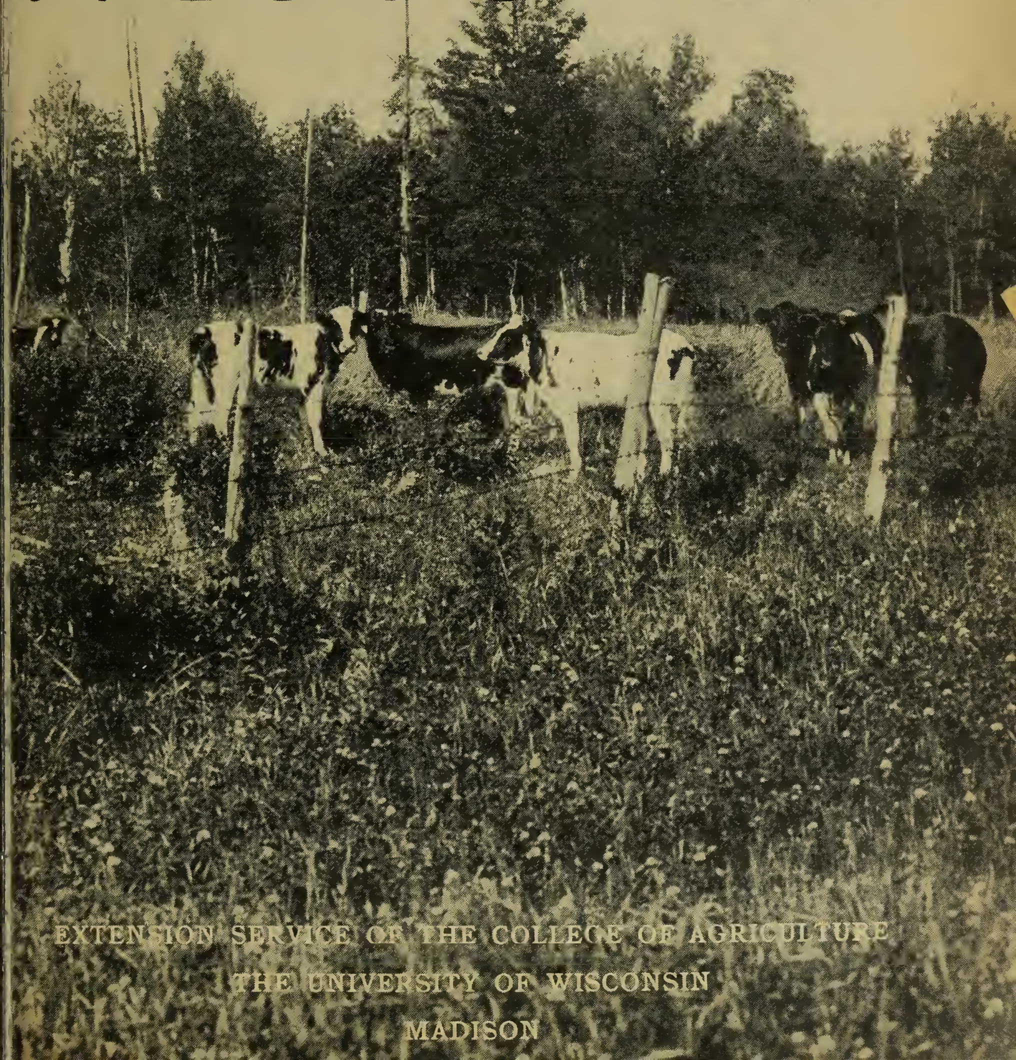
DAIRYING IN NORTHERN WISCONSIN



EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN
MADISON

FOREWORD

To a very large extent the agricultural prosperity of Wisconsin has been dependent upon the successful development of the dairy business. In opening up the new north to settlement, there are even greater possibilities that dairying will be fully as profitable as it has been in the older developed regions of the state. The silt and clay loams of the north are well adapted to resist drought. Cooler climatic conditions on these highly productive soils especially favor the growth of clover and forage crops, so that abundant summer pasturage and winter feed insure cheap milk production. The northern dairy counties are eagerly pushing the campaign for the eradication of tuberculosis and the upbreeding of their dairy stock.

With such a start in the right direction rapid progress is inevitable. It needs no vision of a prophet to forecast the future under these conditions. The herds and flocks on a thousand hills will soon be as common a feature of a north Wisconsin landscape as they now are over the rolling hills of Waukesha and Walworth and the bluegrass slopes of Green and Iowa counties.

H. L. Russell.

Dairying in Northern Wisconsin

G. C. Humphrey

IT WILL PAY every farmer to keep a dairy herd if feed and care can be provided to insure profitable milk production. Milk insures health and strength and reduces the cost of living. Usually a surplus of butter, cream, or milk can be sold at good prices. Skimmilk and buttermilk can be fed to good advantage to chickens and pigs. These facts give assurance that one or more cows will prove a profitable investment.

Keep Only Good Cows.

Don't be satisfied to buy or raise anything but good dairy cows. If necessary, get someone to help make selections and purchases. Use only purebred sires and if possible sires which have proved their ability to get calves of most excellent type. It pays to co-operate in securing and using good sires and in ridding the community of scrub sires.

Judge and build the herd of cows largely on the basis of milk production. Cows of the respective breeds should produce annually the following amounts of milk if they are to return prices for the feeds they eat: Cows of Jersey breeding, 3,500 pounds; Ayrshire, Brown Swiss, and Guernsey breeding, 4,000 pounds; and Holstein breeding, 5,000 pounds. Cows which fail to make these amounts in a year after having had a fair chance should be sent to the butcher. Greater productions should naturally result from good feed and care, and more profitable returns be secured than simply market prices for feed eaten.

Give Good Feed and Care.

Don't try to keep more cows than it is possible to feed and care for well. One cow, well fed and cared for, will make more milk and profit than two or more cows poorly fed and poorly cared for.

A cow to be well cared for should be treated kindly. Rough treatment causes a cow to dry off, or at least reduces greatly the amount of milk she produces. Protect her from cold, chilling weather and from storms and dampness, which are other causes of low milk production.

Expensive Stable Unnecessary.

A warm and comfortable shed or stable can easily be provided for cows without great expense. The stable should be warm enough in the coldest weather to prevent manure from freezing. Keep it clean and comfortably bedded, especially in winter time. On farms with only a small amount of cleared land, one can store and use leaves, marsh hay, or dry sawdust for winter bedding.

Have the stable arranged so that sunlight will shine in and help to warm it in winter. Have just enough openings at some place, preferably near the ceiling, where fresh air will be admitted and the stale, foul air will go out without too much draft or danger of the stable becoming too cold. This will add much to the comfort and health of cows, as well as to their milk flow. It will cost only a little thought and consideration and be like lowering the window from the top in a sleeping room to insure health and the best rest.

FIG. 1.—A PROFITABLE HOLSTEIN FARM.

The owner of this farm does not buy nor raise any but the best of dairy cows. The result is shown in his prosperous dairy farm.

Feed Cows Liberally.

It takes a given amount of feed to keep a cow alive, and an additional amount of feed to produce milk. Cows that are fed in a manner to produce milk ten or more months in a year make a profitable use of grass pasture when in season, and of hay, silage, roots, grain, and mill feeds when an abundance of grass pasture is not available. Grass that grows where the sun strikes the ground is most nutritious and produces the most milk. Cows should be pastured where they can get an abundance of such grass. On undeveloped land it is important to cut, clear and burn the brush and to sow grass seed as soon as possible. Until one has a herd equivalent to five or more mature cows, it will not be economical to have a silo for supplying silage. Roots are most economical to grow and feed dairy cows until one has a silo.

The year may be divided into three feeding periods, approximately as follows:

Summer pasture period, 150 to 180 days.

Early spring and late fall period, 30 to 60 days each, when part pasture and part stable feeding will best serve the cow.

Winter feeding period, 180 to 200 days, when cows should be fed in the stable.

It greatly reduces the income and profit from cows to let their milk production drop down in quantity below normal at any season of the year.

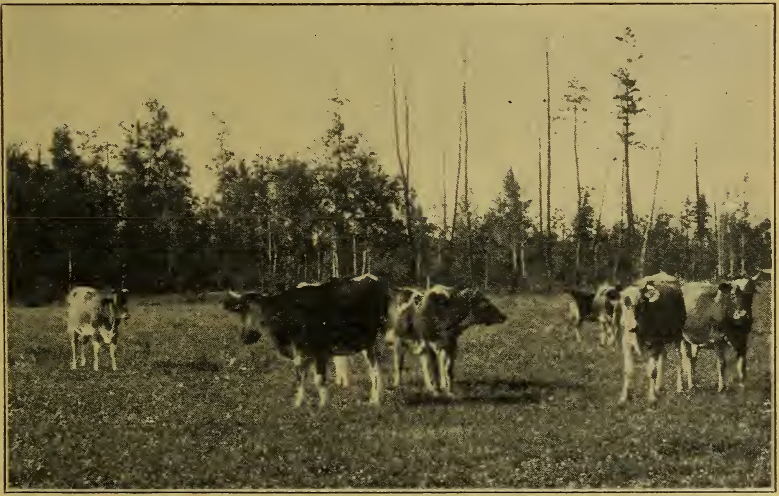


FIG. 2.—DAIRY COWS MAKE A PROFITABLE USE OF GRASS PASTURE.

Grass that grows where the sun strikes the ground is most nutritious and produces the most milk.

What a Cow Needs.

A cow requires at least one acre of good pasture, free from brush and well seeded to grass, to provide her with ample feed for the average grazing season. In some seasons and under many conditions, a much larger area of pasture, or other feed in addition to pasture, will be required for one cow. A mixture of four pounds of red clover, four pounds of alsike and two pounds of timothy has been recommended for seeding new land immediately after the brush has been removed. Sowing and harrowing in such a mixture will add greatly to the pasture and the amount of hay one will secure from new land.

If anything happens that the cow does not receive enough pasture to keep up a good flow of milk, provide her with some other feed like green clover, green peas and oats, and green corn fodder. A half acre of land seeded and planted in three equal strips as follows will produce practically enough green feed to take the place of one acre of pasture, provided the crops grow well.

Strip No. 1	Strip No. 2	Strip No. 3
Seeded to red clover, alsike, and timothy during the previous year.	Oats and peas seeded in the early part of April at the rate of 2 bushels of field peas and 1½ bushels of oats an acre. Amount of seed required for strip: 20 pounds of peas and 8 pounds of oats.	Early and late varieties of sweet corn and a variety of field corn planted in different rows to be cut in the order named. Plant ½ quart of early sweet corn and 1½ quarts of field corn.

Feeding these crops green in combination with one or more acres of pasture would enable one to keep two cows during the summer season.

Provide Abundant Winter Feed.

Do not fail to raise or buy enough feed to keep the cow well fed when pasture is not in season or when it must be supplemented by other feeds. Such feeds should consist of choice hay, roots, or silage, and grain. Clover, alfalfa, or hay made from peas and oats are best suited for milk production. Soybeans can be grown for hay to advantage, especially on light, sandy soil, and compare favorably with alfalfa hay when they are cut successfully at the time the pods are forming and cured without the loss of leaves. With one cow or a herd of cows smaller than the equivalent of five mature cows, roots should be provided to feed with the hay. In addition to hay and roots or silage, cows should receive a mixture of grain equivalent to 1 pound of grain for each 3 to 4 pounds of milk produced. It pays to weigh the milk at each milking time and to feed according to milk production.

Good grain mixtures will be something like the following:

A—To feed with clover hay and roots or silage:

(1)			(2)		
Ground corn	225	pounds	Ground corn	20	pounds
Wheat bran	75	“	Ground oats	20	“
Linseed meal	50	“	Wheat bran	20	“
			Linseed meal	10	“

B—To feed with alfalfa or soybean hay and roots or silage:

(1)			(2)		
Ground corn	40	pounds	Ground corn	60	pounds
Ground oats	45	“	Wheat bran	20	“
Wheat bran	20	“			

C—To feed with mixed clover and timothy hay and roots or silage:

(1)			(2)		
Ground corn	45	pounds	Ground corn	25	pounds
Wheat bran	20	“	Ground oats	25	“
Linseed meal	35	“	Wheat bran	25	“
			Linseed meal	25	“

D—To feed with timothy hay or a poor grade of roughage:

(1)			(2)		
Ground corn	40	pounds	Ground corn	25	pounds
Ground oats	20	“	Gluten feed	35	“
Wheat bran	30	“	Wheat bran	25	“
Linseed meal	30	“	Linseed meal	25	“

Ground barley or hominy feed may be substituted for ground corn in any of the above mixtures.

Provide enough winter feed for at least 200 days. A thousand-pound cow will require about the following amounts of feed:

3,000 lbs. or 1½ tons of hay, approximately 1 acre,
3 tons of roots, approximately ¼ to ⅓ of an acre,
1,000 to 2,000 lbs. of grain mixture.

Reduce Feed Bills.

Save buying the hay and roots by clearing enough land to grow them. If one can grow grains like corn, barley and oats, it will be so much the better; otherwise it will pay to buy what is necessary to make a good mixture.

Do not try to get along without these feeds. Put forth an honest effort to produce them and you will be pleased with the returns. It is wasteful of feed and money to feed incomplete rations.

FIG. 3.—A TYPICAL DAIRY FARM IN DOUGLAS COUNTY.

Even in the extreme northern part of the state, dairying is a profitable business.

Cow-horn turnips make a good crop for new land and fall feeding. Disk or spring-tooth the land and sow late in the season at the rate of 1 pound of seed an acre. Good results have been secured by seeding even after the middle of July. Rutabagas, mangels, and other varieties of roots may also be grown to good advantage. Store roots where they will not freeze and feed them daily in a sliced or chopped condition. A pit or cellar can be easily made in which to store roots.

Feed Sufficient Hay.

Feed approximately 15 pounds of hay daily when pasture is not in season. See that cows clean it all up and do not waste any. In addition to the hay, feed approximately 30 pounds of roots and one pound of grain for each three to four pounds of milk produced, which can be fed over the roots. Provide salt in a box where the cow can get to it as she wants it.

Water the cow twice or three times daily, giving her water in the wintertime that is not colder than that from a deep well. Do not let her have ice water. It takes lots of water to make milk. Do not overlook the matter of watering the cow regularly.

Keep the cow and the stable clean. Be especially careful to keep the milk clean and away from bad odors, which will insure your liking the milk better and getting a better price for milk, cream or butter which is sold.

Protect From Cold.

Do not turn the cow out during cold days for a longer time than she seems to enjoy it. Do not let her become chilled. Blanket her if necessary.

Take out the window of the stable and replace it with a gunnysack or muslin screen during the summer time. If the cow cannot have plenty of shade it will pay to put her in the stable during the hottest part of the day. This will also protect her from flies during the bad fly-time season.

At Calving Time.

Try to have the cow freshen or produce a calf once a year. Breed her to a good purebred bull 70 to 90 days after she has freshened. Two hundred eighty-two days later she will be due to produce a calf. Give her six to eight weeks' rest before calving time by having her dry during this period.

Dry the cow off by milking her only every other time for a few days and then every other day for two days, lengthening the intervals until there are practically no strippings. Reduce the feed during the drying-off period, which will help to get her dry.

After she is dry if she is in thin condition it will pay to feed her four to six pounds or more of grain daily to improve her condition.

When she makes up a large udder and shows signs of producing her calf, feed her only a light ration so that her bowels will be in a laxative condition and she has no tendency to be feverish.

See that she produces her calf where it is perfectly clean and free from any filth and where she can lick and dry the calf immediately after it is born.

If the calf is produced in winter, be careful that the cow is not chilled immediately after calving. Put a blanket over her at this time to avoid a chill. Give her a pail of warm water after she has calved. Do not try to feed her too much during the first two or three weeks after she has freshened. At the first feeding time after the calf is born and the cow has overcome the strain and excitement of calving, let her have a feed of five or six quarts of ground oats or whole oats and wheat bran which has been allowed to stand covered for half an hour in hot water. This will be stimulating and aid her in passing the afterbirth. A hot bran mash containing a pint of linseed meal could be substituted for the oats and bran if oats are not available. Offer her some nice hay, but do not leave hay before her if she does not care for it.

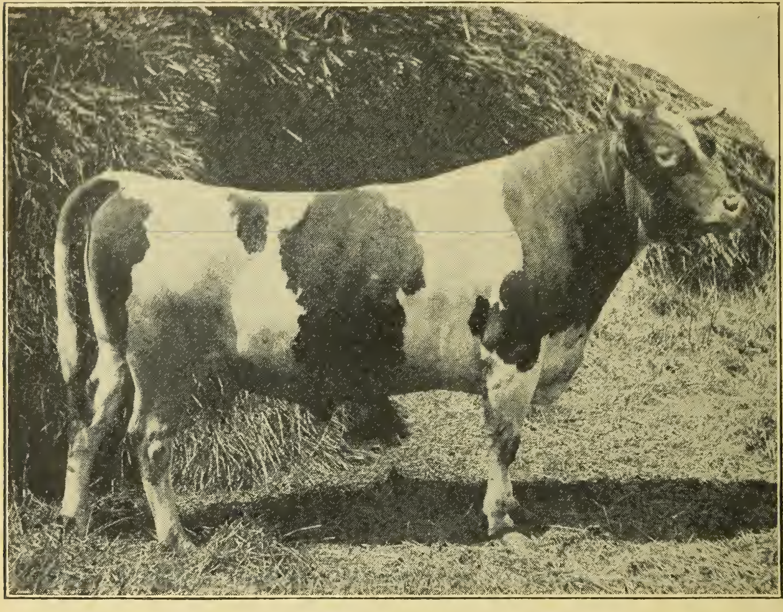


FIG. 4.—AN EXCELLENT PURE-BRED BULL.

Pure-bred sires that have proved their worth are a big factor in building up a high-class dairy herd.

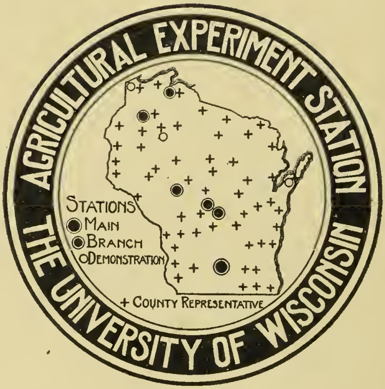
Feed sparingly of grain for a few days and as her milk flow tends to increase gradually increase the amount of grain. It should take three weeks approximately to get a cow on full feed and up to her full flow of milk. See that the calf gets the first milk from the udder and do not milk the cow dry during the first 48 hours.

The afterbirth should pass the first day and be removed from the stable to prevent the cow from eating it. If the afterbirth does not pass, an experienced herdsman or veterinarian should remove it.

If there are any evidences of milk fever, indicated by a nervous, weakened condition, with a tendency for the cow to wobble and lie down, call a veterinarian or someone experienced in treating her. The treatment is to pump air into the quarters of the udder by means of an air pump and a milking tube which is clean and sterilized to avoid any bad infection. Milk fever is not serious if treated properly in the early stages of its development.

FIG. 5.—A PROUD DAIRYMAN AND A PRIZE-WINNING COW.
Wisconsin dairy farmers feel a justifiable pride in their excellent herds.

Treat cows gently at all times and prevent excitement or abuse of any kind from running cows to pasture, loud talking, barking dogs or any mistreatment. It pays to insist upon kind treatment, and so far as possible the same person or persons should care for the cow and do the milking from day to day.



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ular 152 September, 1922

CORN JUDGING

EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN
MADISON

CORN

Corn is the great energizing, heat giving, fat-furnishing feed for animals on the farm. No other cereal yields, on a given space and with a given expenditure of labor, so much food in both grain and forage. On *millions* of farms successful animal husbandry rests on this imperial crop.

As a grain crop in the United States, in acreage, in total yield, and in value, it exceeds all other cereals combined.

—*Henry and Morrison.*

Corn Judging

R. A. Moore and G. B. Mortimer

CORN LEADS all other crops in value in Wisconsin; and the money value of the United States corn crop exceeds the value of all other grains combined. These facts emphasize the importance of improving this, the king of all our agricultural plants.

Corn breeding has given the grower the varieties best adapted to his soil and climate. This has been accomplished in two ways. First, the best of already existing varieties have been determined through field testing, and high-yielding strains within these varieties have been selected. Second, new varieties have actually been created by crossing well-known varieties. The result has been to eliminate many of the nondescript kinds of corn used in the past and to place the crop upon a much higher plane of production.

The farmer must know what features are characteristic of certain types in order to maintain quality and excellence within a variety. Secondly, he must have an ideal of perfection in mind in order to establish a desirable type. Intelligent selection of corn both for seed and exhibit depends upon such knowledge and is accomplished through the art of corn judging.

Corn judging is determining how closely a single ear or any number of ears in a sample conforms to an established ideal. It is, therefore, based upon artificial standards. Judging is an art which can be learned only by sufficient practice through suitable exercises. Standards have been established within recognized varieties of corn which form the basis of corn judging. The description of such standards is what constitutes type for any kind of corn.

For the convenience of judges and others interested in corn judging, the important points to be considered are listed upon the corn score card. A copy of the score card used in Wisconsin for corn judging follows. A thorough mastery of the points on the score card and their relation should be gained before any judging is attempted.

        (3) Shape
        (4) Size
    b. Depth of kernels
    c. Ear characters
        (1) Size—determined by length and circumference
        (2) Shape
        (3) Color of cob—standard for the variety and free from mixture
2. Secondary considerations
    a. Kernels
        (1) Uniformity in size, shape and arrangement
    b. Ears
        (1) Tip and butt
        (2) Furrows between the rows
        (3) Number of rows

It is only through a thorough knowledge of type features that one will ever become able to recognize varieties and standardized types within them. Unless samples of corn are exhibited in a variety class, type is not a feature to which judges pay attention. For example, samples of corn exhibited merely as either yellow or white corn are judged upon features other than type. Type, then, is a study of the characteristics peculiar to the variety and which will be transmitted to the next crop.

Shape and Size of Ears—Within any variety of corn numerous shapes of ears will be noted. The cylindrical ear with a gradual taper toward the tip is most desirable. As a rule, tapering ears have less uniform kernels not regularly arranged and frequently they have a lower percentage of shelled corn. Furthermore, they do not make as good an appearing sample when exhibited for show corn. In addition to being cylindrical, an ear should be straight and have straight rows of kernels.

Each ear should be well proportioned in size. Size is determined by the length and the circumference. In well-proportioned ears of dent corns, the circumference should measure about three-fourths of the length. Long, slender ears are objectionable because they generally have shallow kernels and poorly filled tips and butts. On the other hand, short, thick ears are undesirable, not only from their lack of length, but also because they are liable to possess an oversized cob, usually meaning a low shelling percentage. The proper size is determined both by the variety and the length of the maturing season. A good corn for any locality, if hard corn is expected, should ripen properly. Large-eared varieties are late maturing. For Wisconsin conditions the best varieties range between 8 and 9½ inches in length.

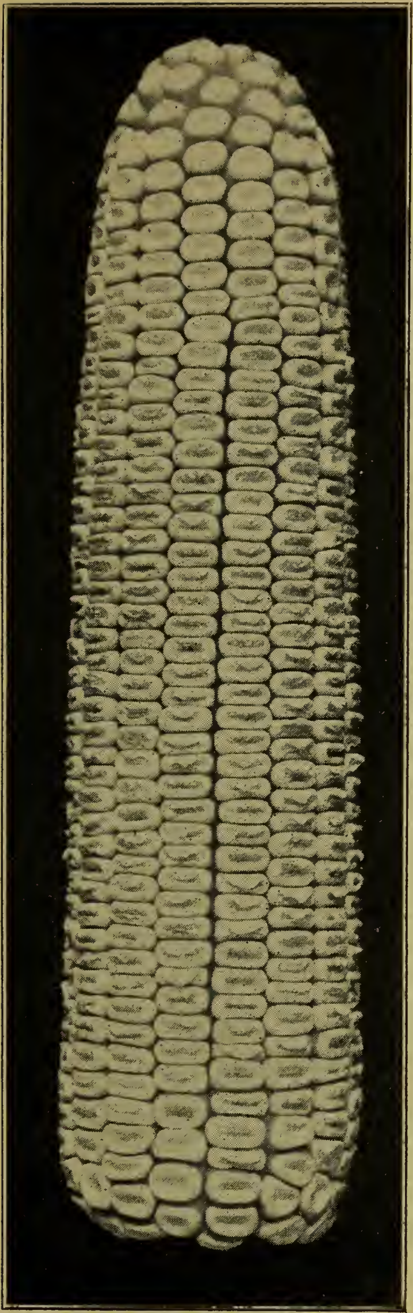

FIG. 1
An ear that is ideal in shape and proportions.

Color of the Grain—When the corn is grown and harvested under normal conditions, color of the grain is one of the more constant features. Although there are variations in color within any variety, a standard color has been set for each of the prominent varieties. Good type will not tolerate colors other than the standard color. In addition, ears should be bright, clean and uniform in color. Ears badly off color are liable to have poor germinating qualities.

Since corn is a plant that naturally cross fertilizes, one should be careful to study the ears closely for mixtures in color which are liable to be present. Mixed seeds will not reproduce truly and hence ears having them do not possess a type for the variety. Judges discount very severely against this condition. Since the common colors in dent corns are either yellow or white, one should know how to detect mixture involving these two colors. Yellow is a color that is dominant over white; hence white corn fertilized with the pollen from yellow varieties will most always show a mixture. Oftentimes it is difficult to detect the mixture because the body of the kernel is the part that has changed color, while the crown or exposed part remains natural. It is therefore necessary to examine white ears critically by looking carefully between the rows of kernels in order to discover the evidence of mixture. When a yellow variety is fertilized with the pollen from a white variety, the mixture is not so liable to be noted since yellow is the dominant color. However, it often may be detected in a change of the color in the crown of the kernels affected. Unless the crowns are decidedly white in color, it is best not to regard variations of color in yellow varieties as mixture. A good judge will always be on the lookout for mixtures.

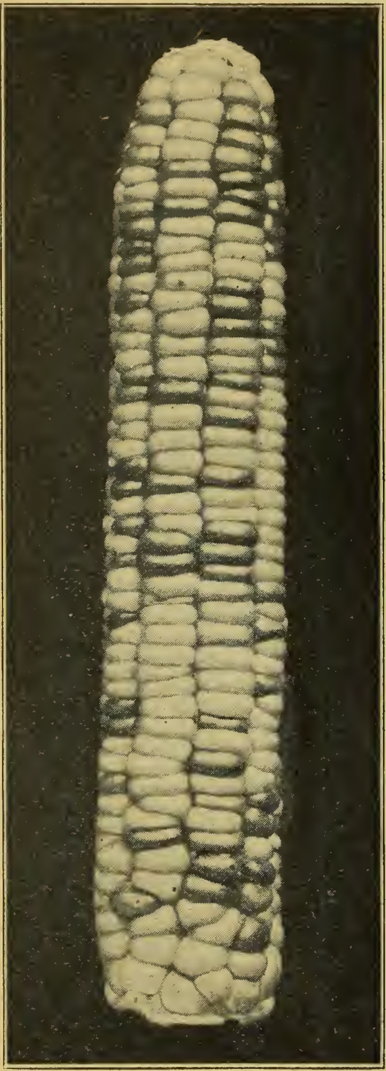

FIG. 2

An ear of white flint corn that shows mixture with yellow flint.

Color of Cob—Cob color should be true to the ideal standard set for it. Usually white varieties have glistening white cobs, while yellow varieties have red cobs. In such cases, white cobs in yellow corn and red cobs in white corn indicate mixture. Even pink cobs are to be regarded as doubtful. In addition, the study of the cob may furnish an index to the vitality of the seed. Dark colored, moldy, sappy cobs indicate seed of low vitality. All such conditions should be carefully guarded against.

Market Condition—Of all the points considered in judging corn, market condition is of the greatest importance to the grower. It has to do with two principal factors—degree of maturity and soundness. Immature corn will not keep well and it quickly loses its power to grow. When immature ears are dried out, the immaturity is indicated by loose, poorly filled kernels and light weight ears. On the other hand, mature ears when cured have plump, well-filled kernels that are set close together so that there is very little, if any, looseness of kernels. Good seed and show corn should be thoroughly sound. Damage of any kind will discredit a sample. Judges and growers cannot be too critical in the matter of knowing what excellent market condition means. A feeder of corn does not care whether it will grow and hence to him germination has little significance. Frequently there are those who think that market condition also deals with shelling percentage and mixture. This is not the case and the two considerations should never be confused.

Tips and Butts—Well-filled and regularly formed tips and butts add materially to the appearance of an ear or a sample of corn. This is more a matter that concerns fanciness than it does practical features. Therefore, it is not nearly as important as market condition, purity and uniformity of the sample. To select ears either for seed or for the show largely from the standpoint of good tips only is a serious mistake. It usually results in the sacrifice of far more important considerations. In a perfectly formed tip the rows extend regularly over the top of the cob so that there is no exposure. Perfect tips are rarely found, but in making up show samples one should select the best he can find and still maintain other more valuable qualities in the ears. Long tapering tips are very undesirable because they usually result in a large percentage of irregular and shallow kernels. In addition, the general appearance of the ear will not be good.

The butts should also be well filled out with regular rows so as to round out nicely about the shank. In most varieties the shank attachment, indicated by the scar, should be about three-fourths the diameter of the cob. Shanks beyond this size usually mean coarse butts covered with large, irregularly shaped kernels. Both tip and butt kernels should be rejected for planting, as they will not feed uniformly through the planter plates.

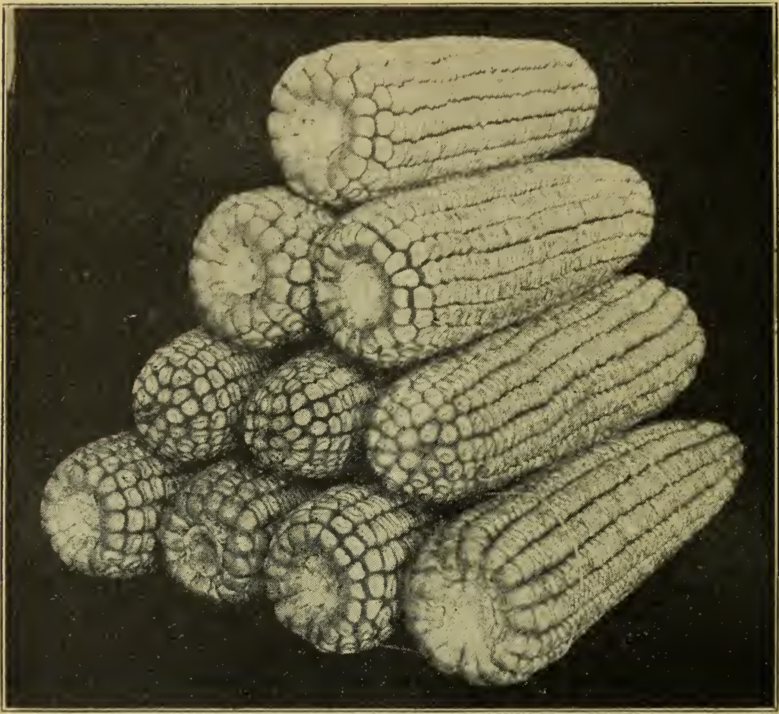

FIG. 3

Ears that possess the desirable features for the variety and in addition are well tipped and butted.

Uniformity and Shape of the Kernels—Uniformity in size and shape of kernels on a single ear as well as among the ears in a sample is a highly desirable feature. It not only indicates good breeding through proper selection, but adds greatly to the general symmetry of the sample or ear. Furthermore, ears with uniform kernels when used for seed will produce a better stand of plants in the field because the planter will drop them at a more even rate. It would be difficult indeed to find ears whose kernels are exactly uniform, but great variations should be guarded against.

In dent corns the medium wedge-shaped kernel is best because it occupies the kernel space on the cob most completely. Square and rounded wedge-shaped kernels permit of wide spaces between the rows. In general, the crown of the kernel should be from two to three times as wide as it is thick. This will give to it an oblong appearance.

Kernel depth is governed largely by two factors—the variety and the length of the growing season. Generally the deeper-kerneled varieties are adapted to sections having long growing seasons and hence will not properly mature when grown farther north. The proper depth of kernel for any variety is the deepest one which will fully mature in the locality where the corn is being grown. Experience in handling corn grown in any section will teach how deep a kernel is to be expected.

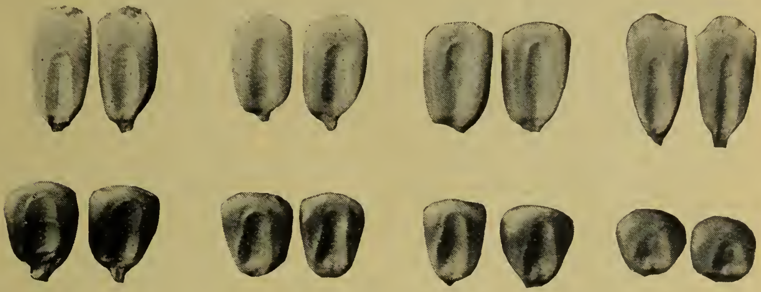

FIG. 4

To judge kernels remove two from each ear two-thirds of the way from butt to tip. Place each pair near the ear from which they were taken and compare with the ideal. The top row illustrates the best while those in the bottom row are too short and thick for dent corn. The long wedge shaped kernels shown at the right of the top row and the two pair in the center of the row are desirable.

Length of the Ear—Although the ears in any variety of corn will show considerable variation in length, still when grown under normal climatic and soil conditions, the majority of ears will conform reasonably well to a given length. This is especially true of the pure-bred varieties. Upon this basis standard lengths for each of the leading varieties have been established. For the northern sections of the state this has been set to range from 8 to 9 inches; for the central sections, from 8¼ to 9¼; for southern section, from 8½ to 9½. Long ears are usually objectionable because they are inclined to have poorly filled tips, irregular butts and shallow kernels. On the other hand, short, stubby ears are inclined to be coarse in every respect. The ears in a sample should be actually measured by means of the scale given at the right hand margin of the score card.

Circumference of the Ear—In a well-proportioned ear the circumference measured at about one-third the distance from the butt will be from three-fourths to four-fifths of the length measurement. Corresponding to the lengths given for corn in the various sections of the state these should be 6 to 6½ inches, 6½ to 7, and 7 to 7½, respectively. A little experience in handling ears of corn will soon make the beginner capable of estimating these measurements accurately. However, he should begin by making the actual measurements.

Spaces Between the Kernels—Straight rows are desirable because the spaces or furrows between them are usually very narrow. Poorly shaped and shallow kernels usually accompany wide furrows. The furrow or groove should not extend to any great depth. It should simply mark the dividing line between the rows. Wide and deep-furrowed ears are liable to be light in weight. Spaces between the kernels at their tips are also very objectionable.

Percentage of Shelled Corn—Shelling percentage refers to the amount of shelled corn obtained from any given weight of ears. While it can only be determined accurately by actually shelling the ears and making the proper calculations, one is able to recognize high and low-shelling ears by studying them for the factors concerning shelling percentages. One hundred pounds of ear corn of average quality will shell about 80 pounds of corn, the remainder being the weight of the cobs. Therefore, it is commonly said that corn shells an average of 80 per cent. One experienced in handling ear corn soon learns to recognize the factors concerned with a high-shelling percentage. The three most important of these undoubtedly are the following: maturity, depth of kernel and number of rows. To these might also be added filled tips and butts, medium-sized cobs and close-furrowed rows. Good seed corn and certainly show corn should shell higher than the average.

WISCONSIN'S BEST VARIETIES OF CORN

Certain varieties that have been found to be most suitable for the various sections of the state and which have been improved through breeding for higher yield and greater constancy of characters have come to be known as the standard varieties. They have resulted in growers producing higher yields and corn of superior quality and have been no small factor in advancing Wisconsin to the front in high acre yields.

Silver King, Wis. No. 7—This is the only standard white variety grown in the state. It is especially adapted to what is termed the southern corn-growing zone of Wisconsin and also is

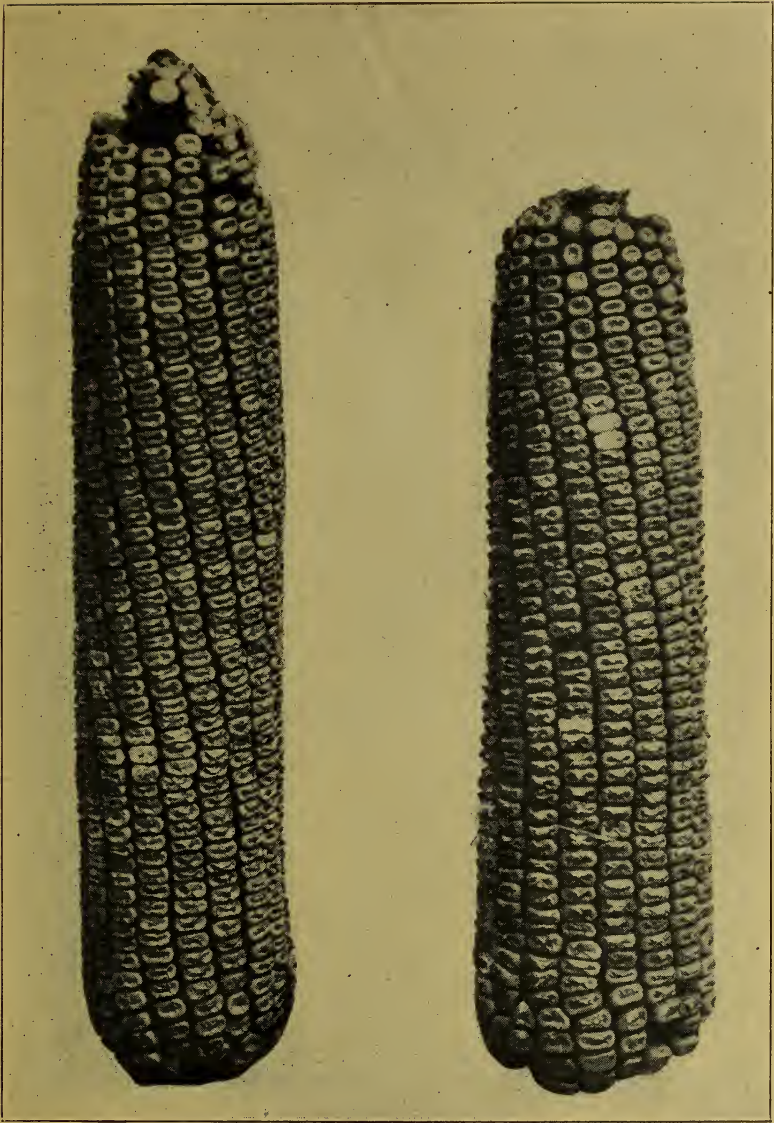

FIG. 5

Ears with spiral rows should not be accepted either for seed or show purposes.

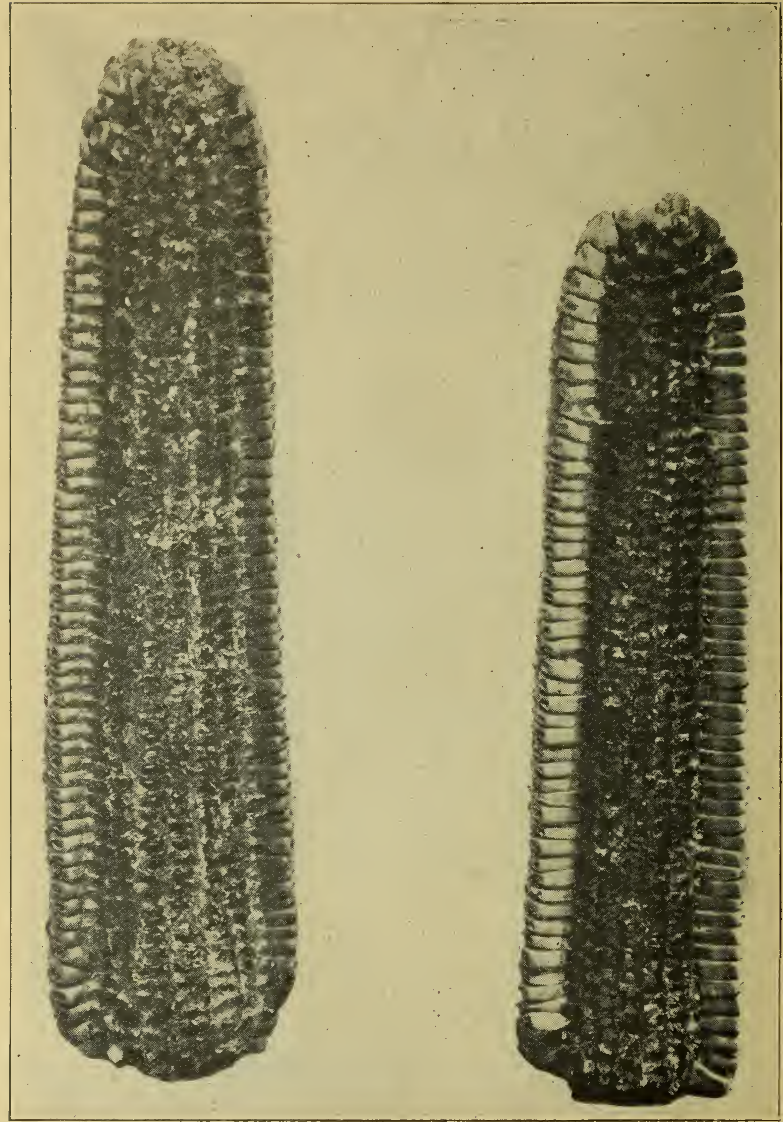

FIG. 6

The ear at the left is coarse cobbed and shallow kerneled and therefore will hardly show a normal shelling percentage. The one at the right shows an opposite condition and will shell a high percentage of corn.

a leading variety throughout northern Iowa. It is considered one of the very best ensilage varieties for high yield. The ears are of average length, ranging from 7 to 9 inches, and have a glistening white cob. The color of the kernels is a creamy white, with a fairly rough indentation. The number of rows usually varies between sixteen and twenty.

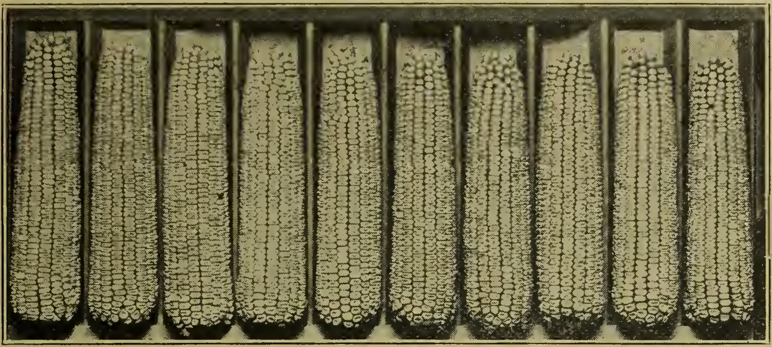

FIG. 7

A sample of Silver King, Wis. No. 7.

Golden Glow, Wis. No. 12—This is undoubtedly the most popular yellow variety grown in the state. It is especially valuable for the southern and central zones of the state on account of its early maturity, hence producing hard, ripe corn. Golden Glow corn was bred out of two other Wisconsin varieties by crossing them and then making the proper selections. The female parent was a large yellow corn, known as North Star, while the male was Early Yellow Dent, Wis. No. 8. The earliness of the latter combined with the good yielding qualities of the former have been combined in Golden Glow to a sufficient degree to make it a very valuable variety as far north as central Wisconsin. It is slightly smaller than Silver King and not quite as rough. The ears are a deep, soft, golden yellow with a medium cherry red cob having from 14 to 18 rows.

Cold-Resistant Golden Glow—Standard Golden Glow has been carried into the northern part of the state through an early maturing strain known as Cold-Resistant Golden Glow. It has all of the good qualities of the parent stock and makes a valuable addition to adaptable varieties for the North.

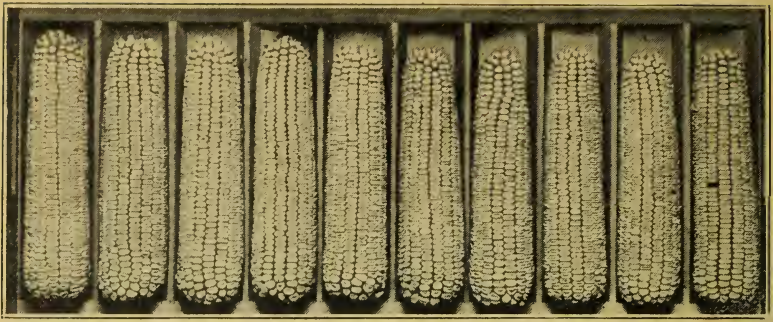

FIG. 8

A sample of Golden Glow, Wis. No. 12.

Early Yellow Dent, Wis. No. 8—This is a standard early maturing yellow variety used throughout the North. It is a special selection from Minnesota No. 13. The ears are smaller than Golden Glow, somewhat lighter yellow in color, smoother in indentation and have fewer rows of kernels. It is not as good a yielder as the larger varieties, but is considered the standard yellow variety for the northern zone of the state, especially for the southern part of this section.

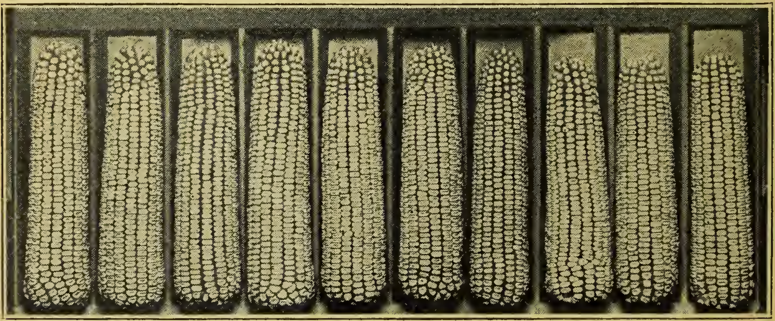

FIG. 9

A sample of Early Yellow Dent, Wis. No. 8.

Northern Yellow Dent, Wis. No. 25—Like Golden Glow, this is also a hybrid variety. Two early maturing varieties were used in the production of it. It was bred especially for the North. The ears are somewhat smaller than Wis. No. 8 and are inclined to show greater variations in color.

Murdock, Wis. No. 13—This variety stands next to Golden Glow in popularity among the yellow varieties for the southern sections of the state. It ranks with Silver King in time of maturity. The ears are about the same size as those of Silver King, having the same number of rows and the same degree of roughness. The kernels are a rich orange color and the cob is a dark cherry red.

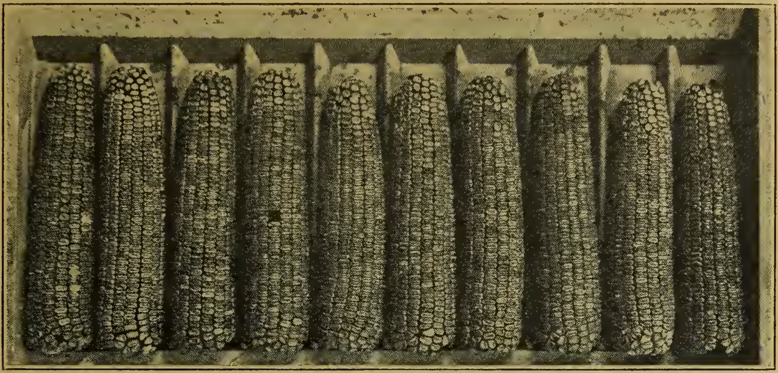

FIG. 10
A sample of Murdock, Wis. No. 13.

Clark's Yellow Dent, Wis. No. 1—This is also a yellow variety grown to some extent in the southern section of the state. It is not as popular as either Golden Glow or Murdock. It resembles Murdock in general appearance, excepting that it has a narrower and rougher kernel.

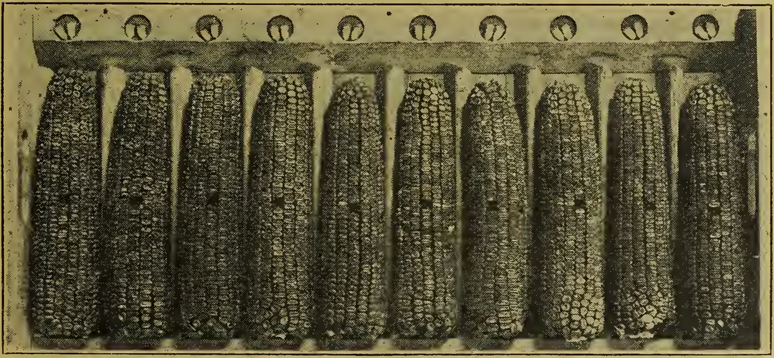

FIG. 11
A sample of Clark's Yellow Dent, Wis. No. 1.

Smut Nose Flint, Wis. No. 15—Of the numerous varieties of flint corn this is considered the best one for Wisconsin. The body color of the ear is yellow with a smoky appearance extending about one-third down the ear from the tip, hence the name given to this variety. It is eight rowed and the ears usually run from eight to eleven inches in length. For a flint variety it is a high yielder both of corn and forage.

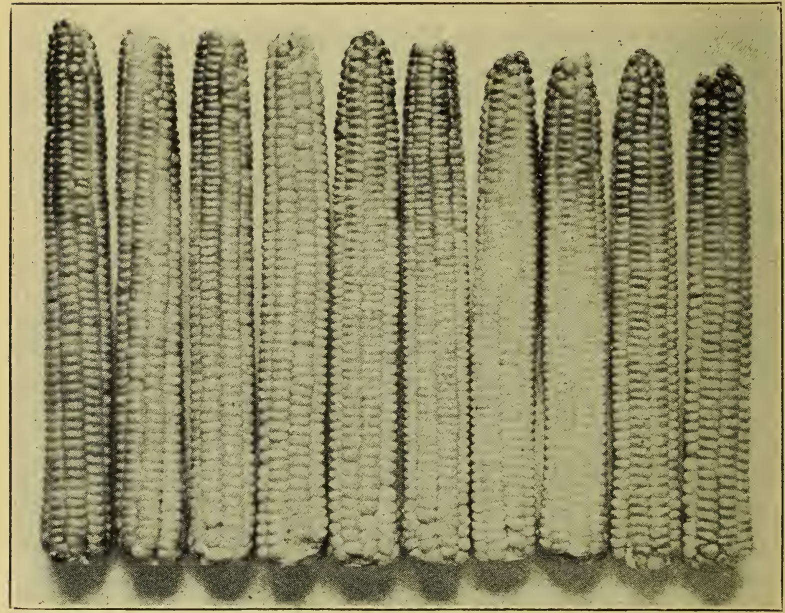

FIG. 12

A sample of Smut Nose Flint, Wis. No. 15.

TABLE I—STANDARDS FOR LEADING WISCONSIN VARIETIES OF CORN.

		Silver King Wis. No. 7	Murdock Wis. No. 13	Golden Glow Wis. No. 12
Ear	Shape	Cylindrical	Cylindrical	Cylindrical
	Length	8½–9½ in.	8½–9½ in.	8¼–9¼ in.
	Circumference	7–7½ in.	7–7½ in.	6½–7 in.
Kernel	Color	Cream white	Orange yellow	Deep yellow
	Indentation	Very crumpled to pinched	Very crumpled to pinched	Crumpled
	Shape	Medium deep wedge	Medium deep wedge	Medium wedge
Rows	Number	16–20	16–20	14–18
	Space	Narrow	Narrow	Narrow
Butt	Shape	Moderately rounded	Moderately rounded	Moderately rounded
	Rows	Straight	Straight	Straight
	Kernels	Nearly uniform with middle of ear	Nearly uniform with middle of ear	Nearly uniform with middle of ear
Tip	Rows	Straight	Straight	Straight
	Kernels	Nearly full size	Nearly full size	Nearly full size
Shank	Diameter	¾-in.	¾-in.	¾-in.
Cob	Diameter	1¼–1½ in.	1¼–1½ in.	1¼–1½ in.
	Color	Glistening white	Dark cherry red	Cherry red
Percentage of corn		87%	87%	86%

		Early Yellow Dent Wis. No. 8	Clark's Yellow Dent Wis. No. 1	Smut Nosed Flint Wis. No. 15
Ear	Shape	Cylindrical	Cylindrical	Tapering
	Length	8–9 in.	8½–9½ in.	10–11 in.
	Circumference	6–6½ in.	7–7½ in.	5–5½ in.
Kernel	Color	Lemon yelow	Orange yellow	Brownish yellow turning to dark red at tip of ear
	Indentation	Smooth	Beaked to pointed	None
	Shape	Short wedge	Deep wedge	Rounding shallow
Rows	Number	12–16	16–18	8
	Space	Narrow	Medium	Wide
Butt	Shape	Shallow compressed	Deeply rounded	Flat
	Rows	Straight	Straight	Straight
	Kernels	Nearly uniform with middle of ear	Nearly uniform with middle of ear	Nearly uniform with middle of ear
Tip	Rows	Straight	Straight	Straight
	Kernels	Nearly full size	Nearly full size	Nearly full size
Shank	Diameter	¾-in.	⅝-in.	¾-in.
Cob	Diameter	1–1⅜ in.	1–1⅜-in.	1–1¼ in.
	Color	Light cherry	Dark cherry red	Glistening white
Percentage of corn		85	87	..

HOW TO JUDGE

In taking up corn judging one should distinguish at the outset between scoring and judging. Scoring corn is assigning numerical values to the sample for each point under which corn is judged on the basis of the ratings allowed each of the items found upon the score card. Judging usually does not recognize all such numerical values, but consists of a double comparison of the ears in the sample with the ideal of perfection and also with each other. Both operations involve immediate comparisons, differing, however, in the use of numerical values. In either case the score card is invaluable in presenting the points to be considered and also to give an idea of their relative values.

Before scoring an ear or a sample of corn suitable exercises in comparison without the use of numerical values will be of great value. Properly conducted they give an opportunity to get acquainted with types and varieties in a manner that will impress standards of perfection as scoring cannot do. When sufficient work of this kind has been done, learning to score is a further step. Teachers and beginners should always remember that the main object is to learn to recognize standard varieties and accepted types within them. Comparative judgment without the use of numerical values will do this admirably. Corn judging cannot be taught without the use of ear corn representing the varieties to be studied. Teachers should appreciate this fact and provide the material at a time best suited to securing it. Little can be done with a few ears of corn to build up suitable exercises for the teaching of corn judging. Stress should be placed upon learning the best varieties for the section in which the work is being done and consequently plenty of material of these varieties should be on hand. Nondescript corn should not be used. From the stock on hand teachers should select those ears which best represent the standard type for the variety. Such ears are necessary for the students to have before them to best impress the ideal of perfection which is essential before they can intelligently proceed.

A SUITABLE METHOD OF PROCEDURE

The first exercise in corn judging should be an explanation of the points to be used. These are all found upon the score card, a copy of which should be in the hands of each student in the class.* In addition it would be well to have several copies of this bulletin in the school library to which the students could be referred. In order to make the proper explanations there should be ears of corn on hand to illustrate the various points taken up. It is not difficult to get such material, and properly cared for it will last a long time. This exercise may consume one or more class periods, depending upon their length. Before proceeding the teacher should be certain that all members of the class have a keen appreciation of each point to be used later on.

The next exercise should be upon a single variety to learn the standard type set for it. (See table I.) With this descriptive material before him the student is ready for the first practice in the art of judging. For materials there should not be less than two ears of corn for each student, representing the variety to be studied. One of these should be considerably better than the other and should be as near an ideal of perfection as possible. The other one is for comparison. With a copy of the score card in the hand the student should compare the second ear with the first for every point upon the card, stating its defects in writing. This demands keen observation and study and makes the exercise very definite. A little practice of this kind will soon perfect his ideal of type for the variety. Care should be taken in these exercises to have the ears to be studied selected so that they will show sufficient variation from the standard in order that differences may be plainly seen.

The next step should consist of the same kind of an exercise, using at least three ears. This will be more complicated for the student, as it involves the double comparison of each ear with the ideal and also each with the other. As many ears as seem advisable may be used for these exercises, although little is accomplished by extending the number beyond five. Each ear should bear a number for reference. With a score card in hand the student will place the ears in their order of merit for each point considered, again stating definite reasons for his judgment. It is well to have the students check over the work of each other. Interest will be added to the exercise and the exchange of ideas will be found very beneficial.

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*Score cards may be had, 100 for 50 cents or in smaller numbers at the same rate, by applying to the Wisconsin Agricultural Experiment Station, Madison.

Having had sufficient practice in these preliminary exercises the beginner is now ready to work with regular show samples of ten ears. Here the problem is to decide upon the merits of the samples, giving to each its relative placing in the competition. The knowledge gained in the preceding work will be applied here. The samples should bring out striking differences, thereby giving the student the opportunity to learn what a first-prize sample of corn is. They should each be numbered and arranged in groups and the student should give substantial reasons for all of his judgments.

SCORING A SAMPLE OF CORN

After the preliminary work in which the student or beginner learns varieties and the desirable types within them according to the standards given, he is ready to learn how to score a sample. Scoring corn is the application of numerical values to the points considered in judging. These are found upon the score card.

HOW THE SAMPLE IS SCORED

After the sample is arranged, each ear is scored for the various points in order, as trueness to type or breed characteristics, shape of ear, color, etc. The following example, showing how a sample is scored for trueness to type or breed characteristics, will show how the sample is judged on each point.

In judging trueness to type, a general study of the ear is made. Under this head the ear is criticized or marked down only from the general standpoint of type factors, and no numerical score is given for other particular points where the ear is weak.

Example. Suppose ear No. 1 has the shape, size, and color of the breed of corn it represents, but is not quite perfect—the color of grain may be slightly off, a few kernels may be off type, or the shape may not conform to the breed. This ear is then considered somewhat off type—that is, it is not quite a perfect ear from the standpoint of trueness to type. It might be cut .2 point under that head.

Ear No. 2 is a fairly good ear, but has a few more defects than ear No. 1. On the points under consideration it is poorer on the whole than ear No. 1, and would be cut .3 point.

This same method is followed with all the ears. Each ear is criticized and a general cut made. Then the sum total of all the cuts is deducted from the total ten points for a perfect score, and the remainder is the rating given the sample on trueness to type. For instance, suppose that the cuts on the ten ears are as follows:

Ear No. 1	.2
Ear No. 2	.3
Ear No. 3	.4
Ear No. 4	.25
Ear No. 5	.35
Ear No. 6	.2
Ear No. 7	.25
Ear No. 8	.15
Ear No. 9	.5
Ear No. 10	.4
Total	3.00

Then 3 points will be deducted from the perfect score of 10, leaving 7 points as the score for trueness to type.

The same method of cutting is used on all points, except that the percentage of corn to cob, and the length and the circumference of ear are determined by actual weight and measurement.

After the student has had several exercises on scoring single ears in a sample he is then required to score the sample as a whole, using the ten ears as a unit. He will make cuts on the entire sample of ten ears similar to the method employed with the single ear. Instead of adding the exact score of the ten ears separately under the various heads judged, he scans the entire ten ears closely and puts down his estimtaed score for the whole ten ears. By using the decimal notation, instead of common fractions as heretofore, the method is very much simplified.

Example. Keeping the score card in mind, the sample as a whole is judged on trueness to type and breed characteristics. Supposing that sufficient defects are found to cut four points, this is then deducted from the perfect score (10), which gives us six, the score of the sample for trueness to type. This number (6) is entered in the proper column on the score card and the examination of the sample under the various headings is then continued. The score on each point is entered as indicated in the score card.

WISCONSIN OFFICIAL CORN SCORE CARD

	Perfect score	Score of sample	
1 Trueness to type or breed characteristics	10	6	0
2 Shape of ear	10	6	5
3 Color: a. Grain	5	3	8
b. Cob	5	3	7
4 Market condition	10	7	5
5 Tips	5	3	5
6 Butts	5	2	5
7 Kernels: a. Uniformity of	10	7	0
b. Shape of	5	3	7
8 Length of ear	10	7	8
9 Circumference of ear	5	3	5
10 Space: a. Furrow between rows	5	3	0
b. Space between kernels at cob	5	3	5
11 Percentage of corn	10	7	5
Total	100	69	5
Cut for general defects		5	0
Final score		64	5

Name...
Sample No..
Remarks...

Adding the score under each head gives a total of 69.5, as is shown on the score card. If the sample shows a pronounced general weakness, points should now be deducted for general defects, as is explained under General Cuts. For example, if in the above illustrations the sample should be cut 5 points for general defects, the final score would then be 64.5.

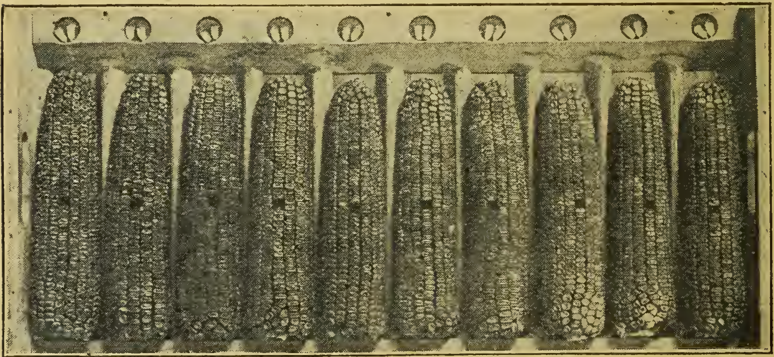

FIG. 13

A sample that is ready for the judge.

RULES FOR SCORING

1. Type: Perfect, 10 points. Ten points are allowed a sample for perfect type features. Since corn does not conform to a perfect type, a study of each ear will usually necessitate a cut.

No ear can be cut more than one point, which is the total allowed each in a ten-ear sample. Variation from the standard type must determine the amount to cut.

Rule for scoring: Deduct one point for each ear which differs radically from the ideal type and less for each that is partially off type.

2. Shape of ear: Perfect, 10 points.

Rule for scoring: Proceed as in type.

3. Color of grain and cob: Perfect, 5 points for each. A perfect score for a single ear within the sample for each of these items would be one-half point. Hence no ear can be cut more than that amount.

Rule for scoring: For each mixed kernel on an ear a cut of one-tenth of a point should be made to the extent of five-tenths for any one ear. Differences in shade of color varying from the standard must be cut according to the variety color. A white cob in yellow corn or a red cob in white corn should be cut the limit of one-half point. Varying shades of color in cobs from the standard should be cut according to the degree of variation.

4. Market condition: Perfect, 10 points. Each ear in the sample is allowed one point for a perfect score on its market condition. The ear should be studied carefully for this characteristic, as it is one of the most important.

Rule for scoring: Cut up to one point for every diseased, chaffy, injured, or immature ear.

5. Tips and butts: Perfect, 5 points for each. No ear in the sample can be cut more than a half point for defects in each of these respects.

Rule for scoring: Tips and butts that do not conform sufficiently close to the standard should be cut according to the degree of defect. Where one inch of cob is exposed at the tip, the full cut of half a point should be made. Irregularity in rows, together with shape and size of tip kernels should also be a consideration. If the butt of the ear is regularly shaped with uniform kernels that extend around it in regular order, allow it a full score. All cuts should be made upon this basis.

6. Kernels: Uniformity and shape: Perfect, 15 points. Two kernels should be removed from about the center of each ear to represent the kernel study for the ear. These are the ones to compare for the entire sample. The entire set of kernels thus removed should show a high degree of uniformity. In shape each set should conform to the standard medium wedge shape.

Rule for scoring: Cut up to one point for each set of kernels that vary too much from the other sets. Cut up to one-half point for each set that is poorly shaped.

7. Length and circumference: Perfect, 15 points. Each ear should be measured for length and circumference by means of the scale given at the right-hand margin of the score card. The length should be taken from tip to butt and the circumference at about one-third of the distance from the butt. Standard length and circumference for the variety being studied should be kept in mind. Excesses and deficiencies should be set down for each ear as they are measured and finally added.

Rule for scoring: Add the deficiency and excess in inches of all ears not conforming to the standard and for every inch thus obtained cut one point on length. Proceed in the same manner for circumference, cutting one-half point for each inch obtained.

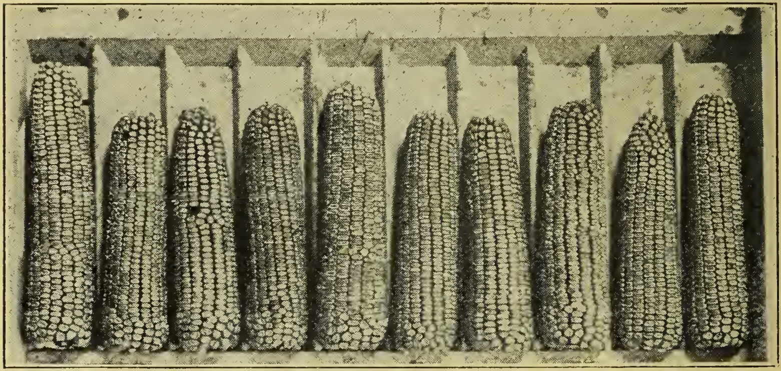

FIG. 14

A sample lacking in uniformity and poorly arranged.

8. Spaces: Perfect, 10 points. Furrows between the rows should be comparatively close and there should be no spaces between the kernels at the cob.

Rule for scoring: Ears showing defects in these two respects may be cut to the extent of one-half point for each.

9. Percentage of corn: Perfect, 10 points. Good seed and show ears should shell a high percentage of the total weight in shelled corn. The standards for each variety should be consulted on this point. To determine the cuts to be made, five of the ears should be weighed and the weight recorded. Then after shelling them and recording the weight of the shelled corn, the shelling percentage should be obtained by dividing the latter number by the former.

Rule for scoring: Cut one point for each per cent short of the standard shelling percentage.

GENERAL CUTS

A defect may be so serious that it should cut down the sample as a whole over and above the cuts given on the ears. An ear in a sample of yellow corn showing all kernels mixed and whitish would indicate that the ear was crossed with white corn and wholly unfit for seed. A white cob in yellow corn, or a red cob in white corn, indicates reversion, which is fully as bad. Any condition which shows that the corn will not germinate, such as moldy cob or moldy corn, would be a defect serious enough to score directly against the sample as a whole.

Rules for scoring: A cut of 10 points should be made for every ear that is crossed, as shown by a great preponderance of kernels of a different color or type.

A cut of 5 points should be made on every ear of yellow corn having a white cob, or an ear of white corn having a red cob.

Every ear that is diseased or damaged in any way so that none, or practically none, of the kernels will germinate, should be cut ten points.

Example. If the sample as scored in the previous example gets a rating of 69.5, and the general defects as above cited demand attention, deduct from the score the number of points necessary for such defects.

SECURING AND KEEPING CORN FOR CLASSROOM STUDY

In order to do the work suggested in this bulletin, schools must be equipped with good ear corn for the varieties to be studied. Sometimes this may be obtained directly from a grower residing in the community. In cases where this is not possible, schools may secure their supplies by writing to the Agronomy Department of the Agricultural Experiment Station, at Madison, who will refer them to reliable parties.

For economy and convenience there should be a suitable place provided for storing the supply of corn when not in use to keep it free from mouse and insect injury. By doing this, ears may be used for at least two years. A box made of matched lumber 3½ by 2½ by 2½ feet and provided with partitions so as to make three compartments will accommodate a large enough supply of ears for at least three varieties. A box so made will be tight enough to permit of fumigation with carbon bisulphide in order to control grain moths. The bisulphide may be purchased at drug stores. A small amount should be poured into a basin that is placed on top of the corn in the box. The cover of the box should be closed at once in order to keep the gas in. Care should be taken not to breathe the gas and lighted matches should be kept from it, as it is very inflammable.

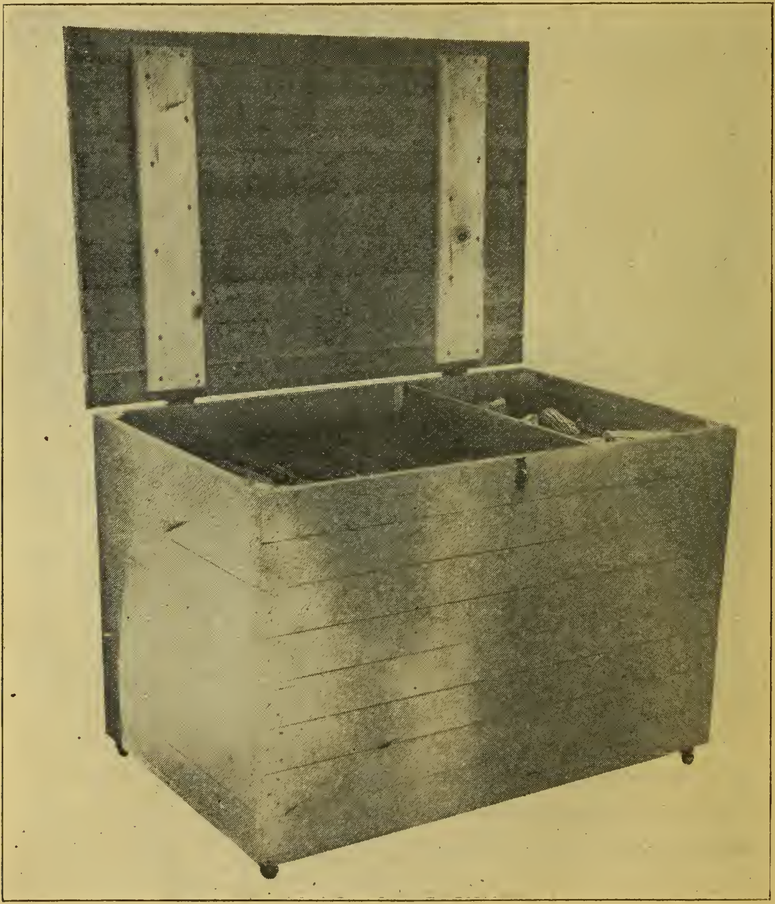

FIG. 15
A suitable box for storing school supplies of corn.

WISCONSIN OFFICIAL CORN SCORE CARD

Name and No. of Scorer..

Sample No.......................... Date.....................................

Scale of Points		1		2		3		4		5	
1. Uniformity and trueness to type	10	....	....	....	....	....	....	....	....	....	....
2. Shape of ear	10	....	....	....	....	....	....	....	....	....	....
3. Color: a. Grain	5	....	....	....	....	....	....	....	....	....	....
b. Cob	5	....	....	....	....	....	....	....	....	....	....
4. Market condition	10	....	....	....	....	....	....	....	....	....	....
5. Tips	5	....	....	....	....	....	....	....	....	....	....
6. Butts	5	....	....	....	....	....	....	....	....	....	....
7. Kernels: a. Uniformity	10	....	....	....	....	....	....	....	....	....	....
b. Shape	5	....	....	....	....	....	....	....	....	....	....
8. Length of ear	10	....	....	....	....	....	....	....	....	....	....
9. Circumference of ear	5	....	....	....	....	....	....	....	....	....	....
10 Space: a. Furrow between rows	5	....	....	....	....	....	....	....	....	....	....
b. Space between kernels at cob	5	....	....	....	....	....	....	....	....	....	....
11. Percentage of corn	10										
Total..............	100										

Reason for student's score on test sample.

Numbers below refer to the various heads under which the samples of grain have been judged.

1...

2...

3...

4...

5...

6...

7...

8...

9...

10..

11..

WISCONSIN OFFICIAL CORN SCORE CARD

Name and No. of Scorer..

Sample No.......................... Date...................................

Scale of Points		1		2		3		4		5	
1. Uniformity and trueness to type	10										
2. Shape of ear	10										
3. Color: a. Grain	5										
b. Cob	5										
4. Market condition	10										
5. Tips	5										
6. Butts	5										
7. Kernels: a. Uniformity	10										
b. Shape	5										
8. Length of ear	10										
9. Circumference of ear	5										
10 Space: a. Furrow between rows	5										
b. Space between kernels at cob	5										
11. Percentage of corn	10										
Total..............	100										

Reason for student's score on test sample.

Numbers below refer to the various heads under which the samples of grain have been judged.

1...
2...
3...
4...
5...
6...
7...
8...
9...
10..
11..

WISCONSIN OFFICIAL CORN SCORE CARD

Name and No. of Scorer..

Sample No.......................... Date..........................

Scale of Points		1		2		3		4		5	
1. Uniformity and trueness to type	10	....	....	....	....	....	....	....	....	....	....
2. Shape of ear	10	....	....	....	....	....	....	....	....	....	....
3. Color: a. Grain	5	....	....	....	....	....	....	....	....	....	....
b. Cob	5	....	....	....	....	....	....	....	....	....	....
4. Market condition	10	....	....	....	....	....	....	....	....	....	....
5. Tips	5	....	....	....	....	....	....	....	....	....	....
6. Butts	5	....	....	....	....	....	....	....	....	....	....
7. Kernels: a. Uniformity	10	....	....	....	....	....	....	....	....	....	....
b. Shape	5	....	....	....	....	....	....	....	....	....	....
8. Length of ear	10	....	....	....	....	....	....	....	....	....	....
9. Circumference of ear	5	....	....	....	....	....	....	....	....	....	....
10 Space: a. Furrow between rows	5	....	....	....	....	....	....	....	....	....	....
b. Space between kernels at cob	5	....	....	....	....	....	....	....	....	....	....
11. Percentage of corn	10										
Total..............	100										

Reason for student's score on test sample.

Numbers below refer to the various heads under which the samples of grain have been judged.

1..
2..
3..
4..
5..
6..
7..
8..
9..
10..
11..

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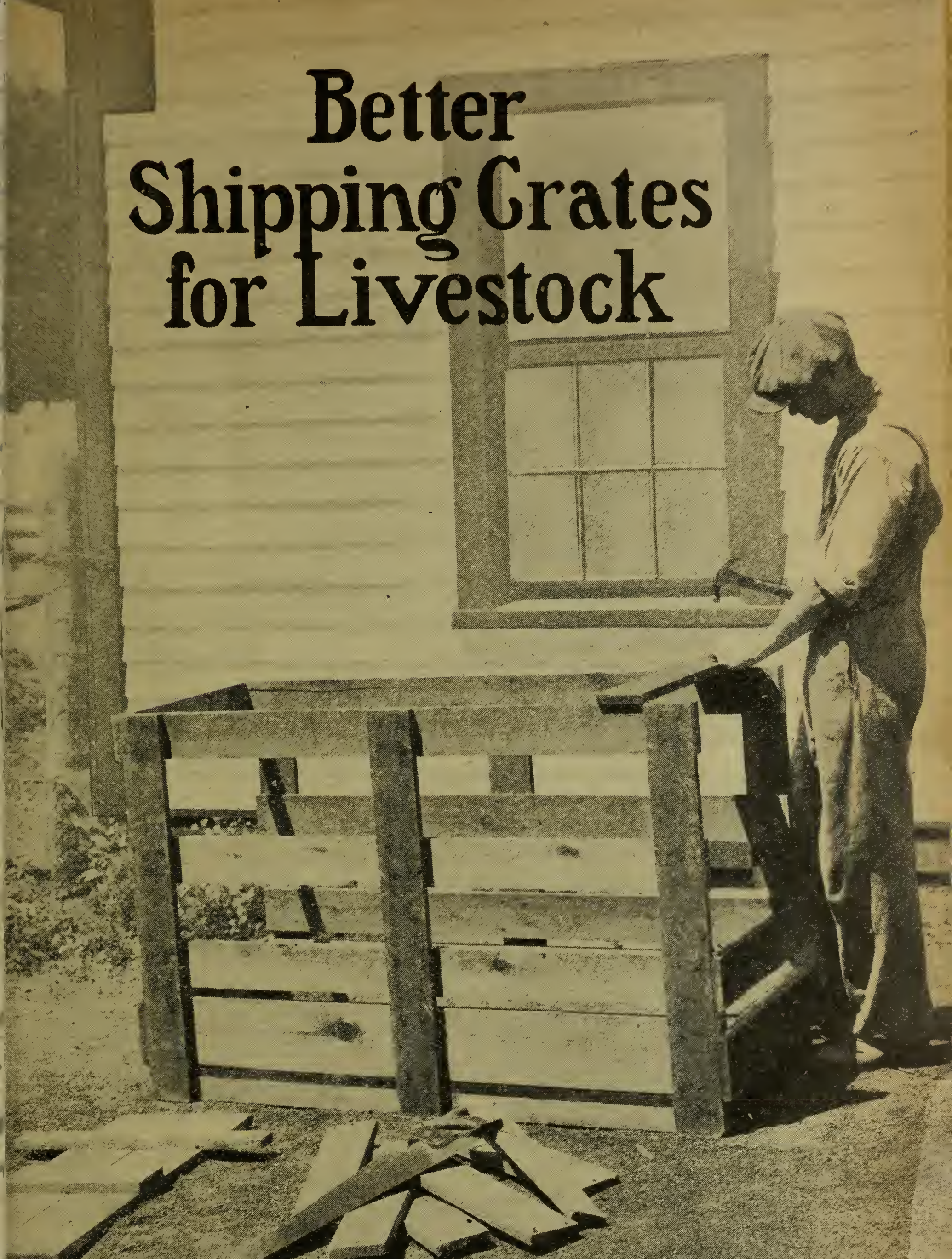
October, 1922

Better Shipping Crates for Livestock



EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN
IN COOPERATION WITH
THE UNITED STATES FOREST PRODUCTS LABORATORY

POOR CRATES cost the stockmen of this country thousands of dollars every year.

There is no one fault common to our livestock crating practices. Instead there may be one or more of many causes for trouble in shipping breeding animals. There may be too much lumber in one crate; too little in another; weak corner construction; lack of bracing; too few nails; or nails of the wrong size—some too small to hold, others so large that they split the wood; nails driven into the end grain and consequently of very little holding power; insufficient protection for contents. These are the most obvious weaknesses in the crates of shippers today.

Crate construction need no longer be a matter of guesswork, for definite principles have been established by the experience of shippers and expressmen, and by the observation and experiments of such agencies as the United States Forest Products Laboratory, the College of Agriculture, and the Wisconsin Livestock Breeders' Association.

Better Shipping Crates for Livestock

VERY MANY of the breeding animals used in improving herds and flocks are shipped from place to place in crates. Good crates are easy to handle, reduce shipping costs, and save heavy losses.

Because shipping is often a source of much loss and great annoyance an attempt has been made to establish a standard type of livestock crate that can be easily and cheaply built.* Practical tests have been made and in every case these standard crates withstood the treatment encountered in actual shipping operations.

Crates have been made for three classes of livestock—cattle, sheep and hogs. The cattle crate will comfortably accommodate mature cows of all breeds of dairy cattle. The same proportions may be used in building a larger crate to accommodate animals of the beef breeds. Similarly, a smaller crate may be built on the same lines in which to ship animals of the smaller dairy breeds.

The sheep crate is best made in three sizes, designated as lamb, sheep, and buck. It is of prime importance that the crate fit the animal. The construction does not differ, only the size of the crate.

Hogs, like sheep, require different sized crates. A crate that is too small may cause many blemishes which will ruin the animal from the breeder's viewpoint. A table of the sizes of crates, based upon the size of the hog to be shipped, will aid the shipper in avoiding waste and, at the same time, provide the most comfort.

What Makes a Good Crate?

Authorities are agreed that certain qualifications are essential for a good crate. It should be (1) light in weight; (2) of proper size and construction to protect the animal during transit; and (3) durable.

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*Representatives of the Forest Products Laboratory of the United States Department of Agriculture and officers of the Wisconsin Livestock Breeders' Association, and members of the agricultural staff of the University of Wisconsin, have cooperated in the work. They have been ably assisted by representatives of manufacturers of livestock equipment and by employes and officials of railroads and express companies.

White pine is an excellent wood for crates. In the same class with white pine are aspen or popple, basswood, cottonwood, cypress, chestnut, jack pine, Norway pine, spruce, western yellow pine, and yellow poplar. Harder woods may also be used, but are more difficult to nail and heavier in weight. The material recommended for crate building is 1 inch thick and 4 inches wide.

The floor has been one of the weak points in crate construction in the past. Boards nailed on lengthwise and fastened to the bottom slats fail to give strength and often cause grief to shipper and receiver alike. To avoid this weakness, the floor of the standard crate is laid crosswise on 2 inch by 2 inch skids. (2 inch by 4 inch for cow crates.)

New Features in Crates

Many animals are shipped in crates that are too small, thereby cramping the animal and often causing injury. Sometimes a crate is too short, and the animal must put its head outside the bars. In this way many valuable animals have been severely injured by falling objects.

In the standard crate this discrepancy has been remedied. The stanchion in the cow crate is on the inside and plenty of room is allowed the head of the cow. The sheep and hog crate designed are long enough to accommodate comfortably the whole animal.

Feeding provisions are also made for extremely long trips on the road. The inside stanchion allows plenty of space for hay and grain in front of the cow. A small trough can be placed in the hog crate; a feed bag can be tied to the crate in front of the sheep.

Preventing Broken Legs

The newly designed crates eliminate the danger of animals getting injured by pushing a foot or leg through the crate. To prevent this the lower slats are nailed close together for a distance of at least a foot above the floor.

An end gate which is easily handled is another extremely desirable feature of a livestock crate. No hinges, straps, hooks or padlocks are necessary except the two hinges and lock on the cow crate. This makes for simplicity of construction, and, at the same time, is a great aid in the loading and unloading of animals. Such end gates also save the wear and tear on a crate which accompanies the knocking off and renailing of the end slats.

Building Guide

No matter which crate you build, be it for a cow, sheep or hog, the method is essentially the same. A few hours' work will complete a crate that should last for a long time, even

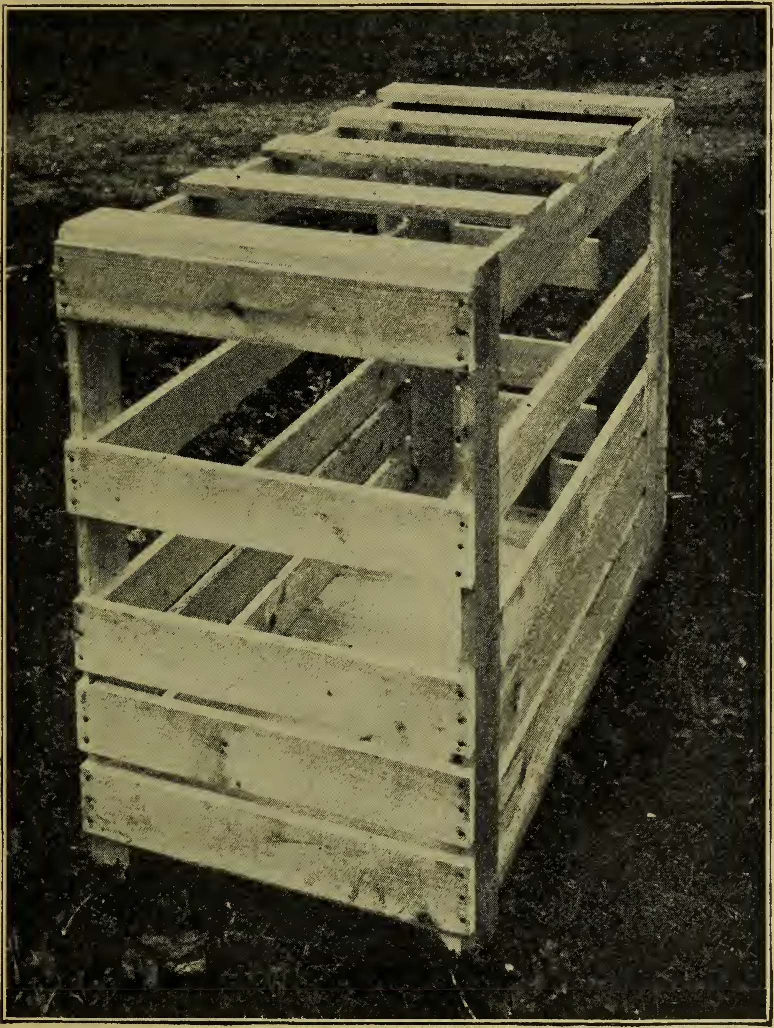

FIG. 1—SAFETY FIRST.

In shipping sheep a well designed crate is the best insurance policy a breeder can hold.

with hard usage. These are the steps in the simplest method of crate construction:

I. Build the floor first.
   1. Cut the two skids 2″x2″. (2″x4″ for cow crate.)
   2. Cut the floor boards.
   3. Nail the floor boards squarely across on the skids.

II. Build each side separately.
   1. Cut four uprights, two for each side.
   2. Cut enough slats for both sides.
   3. Nail the slats on the uprights proper distances apart.
   4. Cow crates require braces. These should be put on next.

III. Nail the sides onto the floor by nailing the uprights to the skids.
   1. Remember that the slats are on the inside of the crate.
   2. Drive the nails so that the heads will be on the inside and clinched on the outside of the crate.

IV. Cut the top and end slats.

V. Nail the top and end bars, spacing properly.

VI. Build the end gate.

VII. Put in stanchion. (For cow crate only.)

Building the Hog Crate

With a hand saw, a hammer, a square, and a pencil, lumber and nails, a box for a saw horse, and the "building guide," you are prepared to build a livestock shipping crate. Because of its simplicity the hog crate is discussed first.

HOG CRATE—INSIDE DIMENSIONS

For Hogs 100-225 pounds weight

Inside Width	1 foot and 6 inches
Inside Height	2 feet and 9 inches
Inside Length	4 feet and 4 inches
Weight of Crate	80 pounds

The Floor—Cut a piece of 2x4 to a length of 4 feet 4 inches. Then rip to make the two skids. Cut the floor boards 20 inches long. Nail the floor boards to the skids with two or three 7-penny nails in each end of the boards.

It is well to leave cracks from ¼ to ⅜ inches wide between the floor boards. This allows for the shrinkage and swelling which accompanies weather changes and wetting and dryin

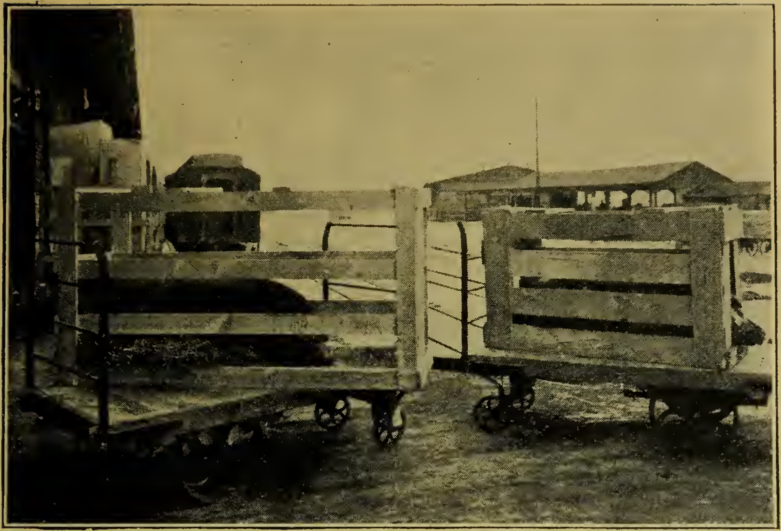

FIG. 2—TWO TYPES OF POOR CRATES.

The one on the left is large enough but of poor construction. The other crate has solid enough construction but is too short.

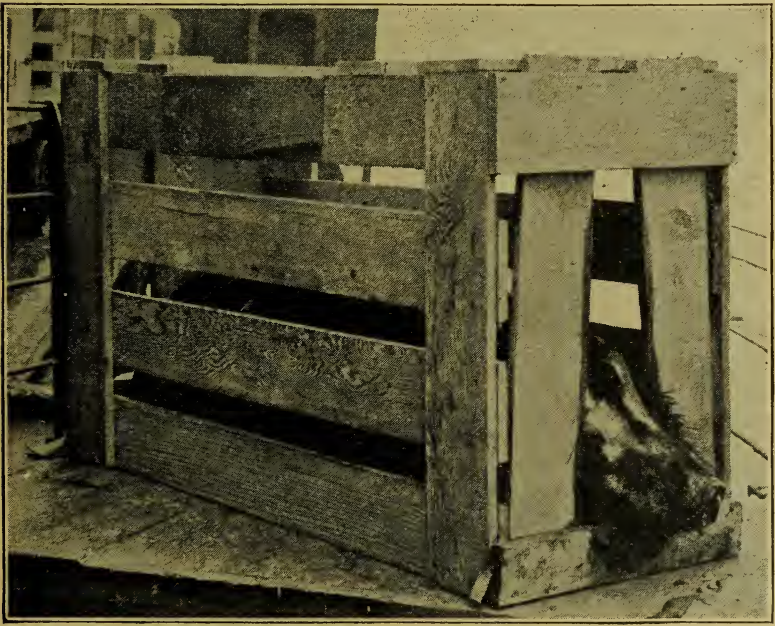

FIG. 3—THIS PIG "WENT TO MARKET."

But much sooner than was anticipated. The crate was too short. The pig stuck his head out and a falling piece of machinery did the rest.

The Sides—The bottom board is of 6-inch width. The rest of the slats on the crate are 4-inch. Cut three uprights for each side, each 3 feet long and lay them on the ground. In placing the slats on the uprights the top slat is nailed even with the ends of the uprights. Measure the thickness of the floor plus the skid and place the bottom slat this distance from the other end of the upright. This will make the bottom slat rest on the floor when the crate is assembled. The second slat is nailed on 1 inch above the bottom slat. Sixteen inches

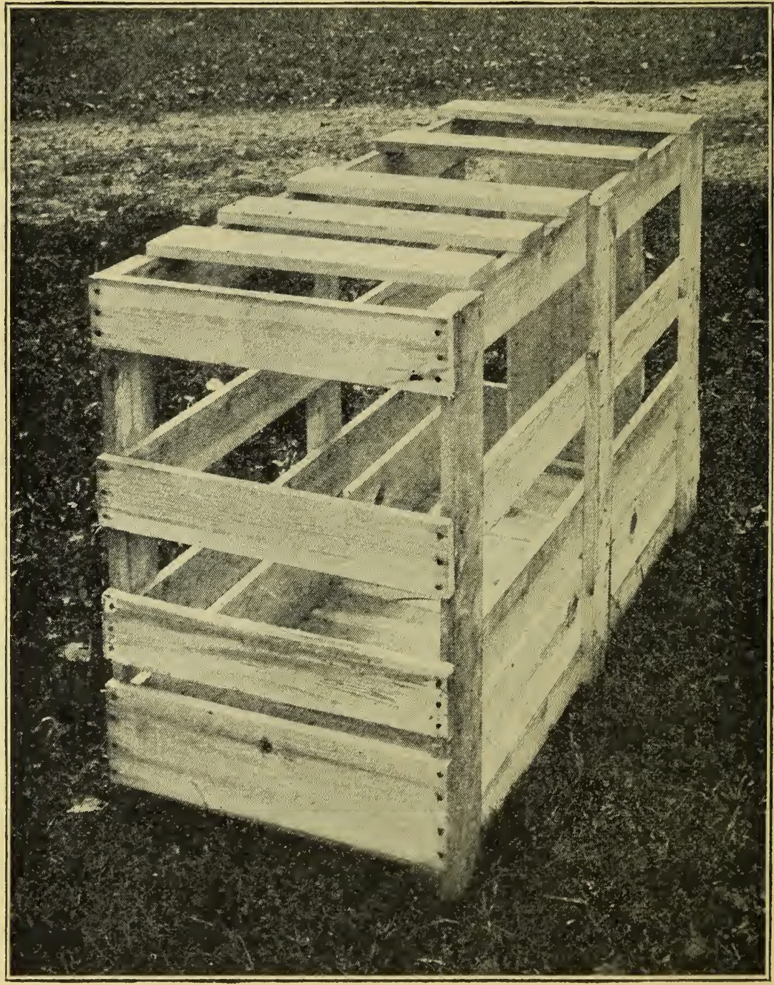

FIG. 4—HOG CRATE READY FOR ITS PASSENGER

The completed crate gives assurance of both safety and comfort.

from the floor nail the third slat. Four 6 or 7-penny nails where the slats and the uprights cross one another give good strength to the side. The nails should be long enough to go through and clinch well on the *outside* of the crate.

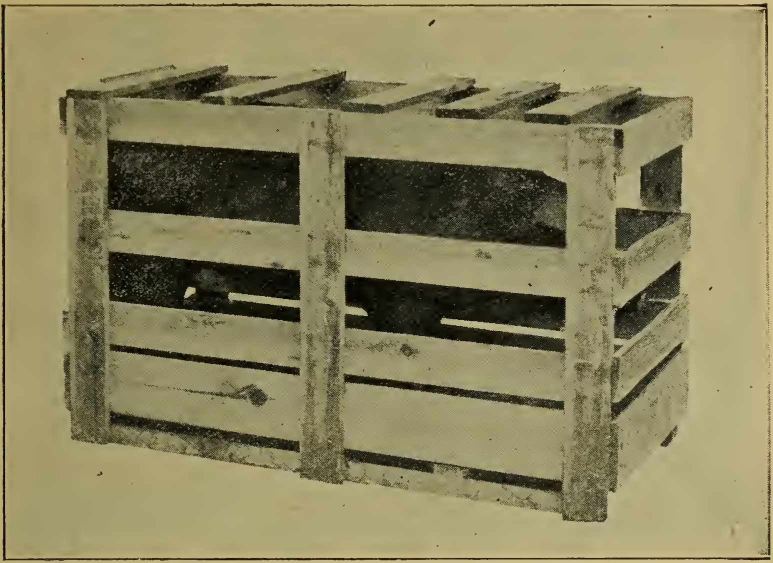

FIG. 5—READY FOR THE JOURNEY

This hog should have a comfortable care-free ride. The crate is substantial and roomy.

Floor and Sides Together

Steps I and II of the building guide have now been covered. The lower ends of the uprights are next nailed to the skids with 3 to 5 nails for step III. Remember that the slats are on the inside of the uprights.

One bottom board 3 inches wide and another bottom board 6 inches wide are now cut 1 foot 10 inches long. There are five 4-inch slats of the same length—three for the closed end, one for the top at the gate end and one above the gate. These slats are now nailed in place, completing step V.

The spacing of slats at the front end corresponds with the spacing of the side slats, except that the second slat is 2 inches above the bottom slat to allow ample breathing space for the hog. Four cross pieces for the top are 20 inches in length and are spaced 4 inches apart on the front half of the crate and 10 inches on the rear half.

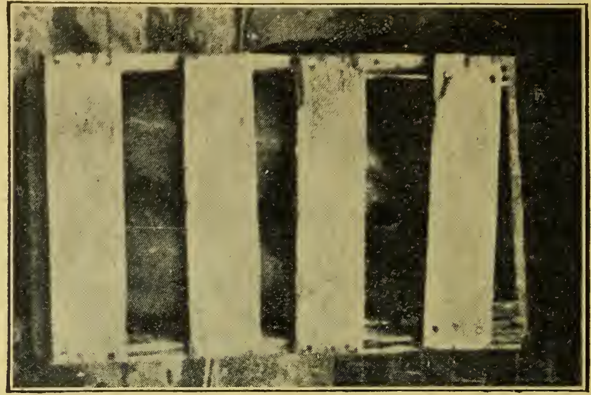

FIG. 6—TWO PIGS—ONE CRATE.

Overcrowding hogs in shipment is sure to mean loss to the shipper.

Construction of End Gate

Two 6-inch boards 2 feet 11 inches long, nailed together with a 2-inch cleat, form the door on the open end of the hog crate. The cleat is 1 foot 10 inches long, nailed on the outside of the door, and is placed so that it rests 2 inches above the bottom board. Also nail a 1x4 piece (12 inches long) 1 foot 3 inches above the cleat to hold the top of the door together. The gate uprights fit into a notch cut in the top cross-piece.

MATERIAL NEEDED FOR HOG CRATES

For 100 to 225 pound hogs

Ends—	
4 slats	1″x4″x1′10″
1 slat	1″x6″x1′10″
1 slat	1″x3″x1′10″
Sides—	
6 uprights	1″x4″x3′0″
6 slats	1″x4″x4′4″
2 slats	1″x6″x4′4″
Floor—	
2 skids	2″x2″x4′4″
Flooring	in 20″ lengths
Total length of floor	4′4″
Top—	
4 slats	1″x4″x1′8″
1 slat	1″x4″x1′10″
End Gate—	
1-2″ strip	1′10″ long
2 boards	1″x6″x2′11″
1 piece	1″x4″x12″

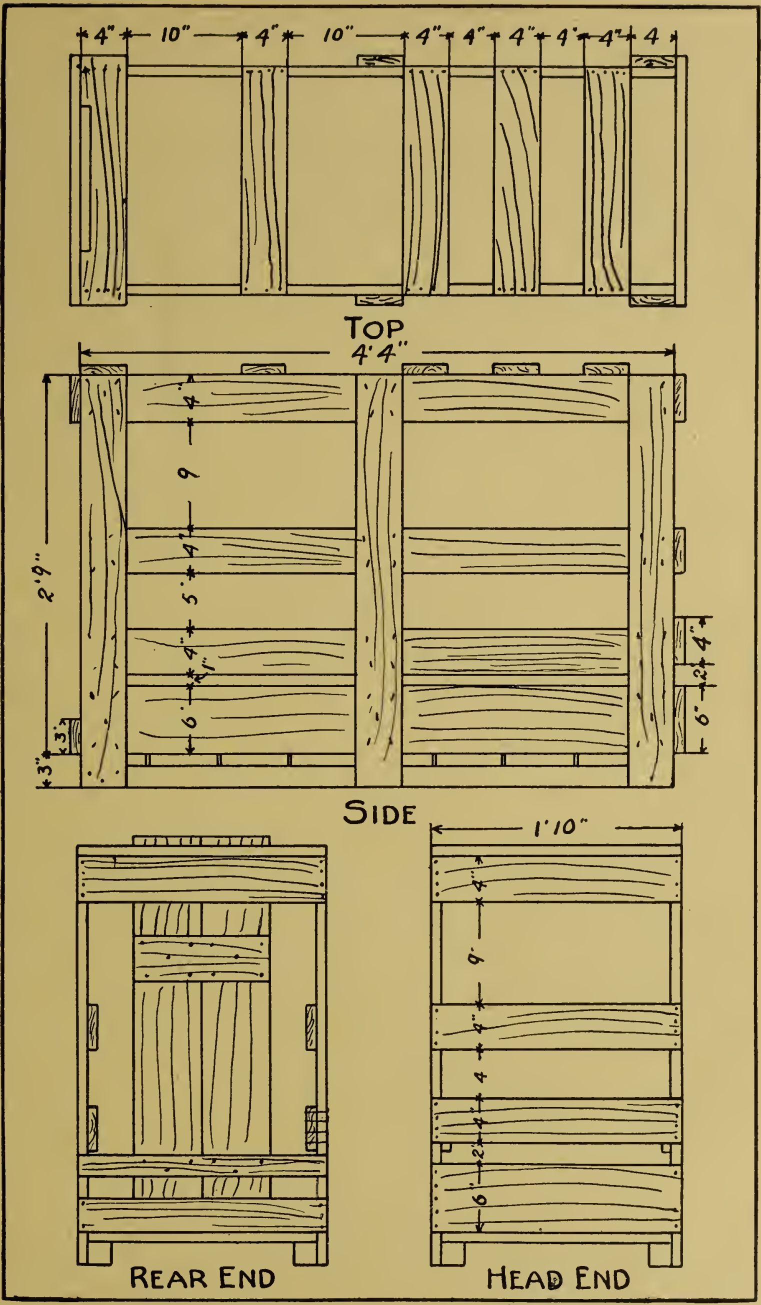

FIG. 7—WORKING PLANS FOR THE HOG CRATE.

INSIDE CRATE DIMENSIONS

For pigs 225 to 500 pounds weight

Width	2'0"
Height	3'4"
Length	6'6"
Ends—	
4 slats	1"x4"x2'4"
1 slat	1"x6"x2'4"
1 slat	1"x3"x2'4"
Sides—	
6 uprights	1"x4"x3'7"
6 slats	1"x4"x6'6"
2 slats	1"x6"x6'6"
Floor—	
2 skids	2"x2"x6'6"
Flooring	in 26" lengths
Total floor length	6'6"
Top—	
4 slats	1"x4"x2'2"
1 slat	1"x4"x2'4"
End Gate—	
1-2" strip	2'4" long
2 boards	1"x6"x3'6"
1 piece	1"x4"x12"

INSIDE CRATE DIMENSIONS

For pigs up to 100 pounds

Width	1'0"
Height	2'0"
Length	3'10"
Ends—	
4 slats	1"x4"x1'4"
1 slat	1"x6"x1'4"
1 slat	1"x3"x1'4"
Sides—	
6 uprights	1"x4"x2'3"
6 slats	1"x4"x3'10"
2 slats	1"x6"x3'10"
Floor—	
2 skids	2"x2"x3'10"
Flooring	in 14" lengths
Total length of floor	3'10"
Top—	
4 slats	1"x4"x1'2"
1 slat	1"x4"x1'4"
End Gate—	
1-2" strip	1'4" long
2 boards	1"x6"x2'2"
1 piece	1"x4"x12"

INSIDE CRATE DIMENSIONS

For aged animals, 600 to 800 pounds

The following are approximate:

Width	2'2"
Height	4'0"
Length	7'0"

Building Sheep Crates

The Floor—The 2-inch skids are of 2x2 material and 4 feet long. The two skids can be ripped from a single 4-foot length of 2x4. The flooring is cut 23 inches long and nailed across the skids. Cracks about ¼ of an inch wide should be left between the floor boards to take care of shrinking and swelling. Four 7-penny nails in each board make a solid floor, two nails being driven into each skid.

INSIDE DIMENSIONS OF SHEEP CRATES

Length	4′0″
Width	1′9″
Height	2′10″
Weight of crate	75 pounds

Construction of Sides

All slats on the sheep crate are of 4-inch stock, 1 inch in thickness, except one 3-inch slat which is put on the bottom of the rear end of crate. When cutting material for one side the quantity can be doubled and considerable time will be saved. Cut ten slats, 4 feet long. The uprights, four in number, are 3 feet 1 inch in length. This allows 3 inches for the combined thickness of the floor and skid when the crate is put together. The inside height of the crate above the floor is 2 feet 10 inches.

The bottom slat is nailed onto the uprights with its ends flush with the outside edges. Its lower edge is 3 inches above the ends of the uprights. The lower edge of the bottom slat will then come just to the top of the floor. It is five inches from the floor to the bottom of the second slat.

The bottom of the third slat comes 10 inches from the floor, the fourth slat 1 foot and 7 inches and the upper edge of the top slat even with the top end of the upright. Four 7-penny nails in each end of a slat are driven through the upright and clinched on the outside of the finished crate.

Getting Ready to Finish

The crate is now ready to be put together. With the exception of three slats, the 12 pieces used to cover one end, the two ends of the top and the end gate are all 2 feet 1 inch in length. The other three slats are 1 foot 11 inches long and are used to cover the top.

The sides are now nailed to the skids with the slats on the inside of the crate. The lower edge of the bottom slat sets directly on the floor. Drive four nails into each upright in fastening the sides to the skids.

To hold the skeleton framework intact a slat is nailed across the top between the uprights at each end. Flush with the lower edge of these cross-pieces, nail another slat across each end. Space the other four end boards on the closed end the same as the side slats.

The top is closed up with three boards 1 foot 11 inches long, spaced 7 inches apart.

Making the End Gate

The gate sets in the end in such a way that it is perfectly secure and without other means of fastening.

The two uprights on the gate are 2 feet 6 inches long. The three cross-pieces are 2 feet 1 inch long, and so spaced on the uprights as to correspond with the spacing of slats on the sides. In making the gate, the cross-pieces are nailed on so that they extend 2 inches beyond the uprights.

The cross-pieces are spaced as follows: Number 1 is 3 inches from the lower end of the uprights; Number 2 is 8 inches from the end, and Number 3 is 17 inches.

A small block of wood 1 inch by 2 inches thick and 6 inches long nailed on the underside of the lowest cross-piece maintains the proper spacing between the bottom end slat and the lowest cross-piece on the gate. The gate is now set in place by putting the upper end in first.

The recommended sizes for sheep crates are given in inside dimensions. The lamb crate should be 3 feet 4 inches long, 1 foot 5 inches wide and 2 feet 6 inches high. The inside dimensions of the buck crate are 4 feet 5 inches in length, 2 feet 1 inch in width, and 3 feet 2 inches in height.

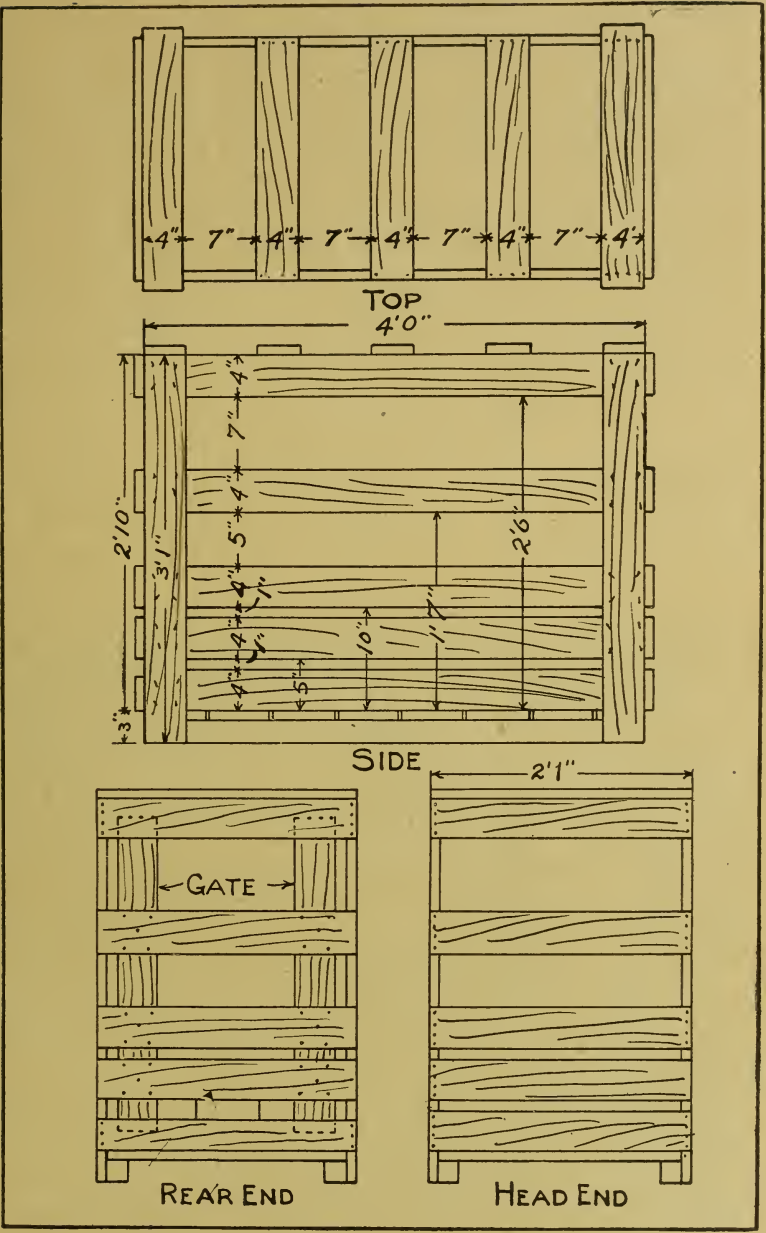

FIG. 8—WORKING PLANS FOR THE SHEEP CRATE.

SHEEP CRATE PARTS

Ends—	
6 slats	1″x4″x2′1″
1 slat	1″x3″x2′1″
Sides—	
4 uprights	1″x4″x3′1″
10 slats	1″x4″x4′0″
Floor—	
2 skids	2″x2″x4′0″
Floor boards	in 23″ lengths
Total length of floor	4′0″
Top—	
3 cross-pieces	1″x4″x1′11″
2 cross-pieces	1″x4″x2′1″
Gate—	
3 slats	1″x4″x2′1″
2 uprights	1″x4″x2′6″

Cow Crate Construction

Though much bigger and bulkier than either the sheep or the hog crate, the cow crate is simple in construction. A few extra braces and a stanchion and a heavier floor are the only changes in construction.

INSIDE MEASUREMENTS OF COW CRATE

Length	8′6″
Width	3′2″
Height	5′1″
Distance in front of stanchion	2′2″
Weight of crate	295 pounds

The Floor—Because of the greater weight of the animal, more strength and rigidity is given the floor by the addition of a cleat. The skids are 8 feet 6 inches long and of 2x4 material. The flooring is of 1½ inch thickness for greater strength and is laid in 3 feet 4 inch lengths across the three 2x4s. About one-fourth inch space is left between the boards. The cleat is midway between the skids and is only of sufficient length to extend to the stanchion.

The Sides—Cut four end uprights (two for each side) 5 feet 4½ inches long and of 6-inch lumber. Cut also two 4-inch intermediate uprights 4 feet 1 inch long (one for each side) to be nailed in the middle of each side. Cut four pieces 1 foot 7½ inches long, four diagonal braces, each approximately 6 feet 2 inches long, 10 slats of 4-inch material and 8 feet 6 inches long, for sides. For the bottom side boards, cut two 6-inch boards 8 feet 6 inches long.

In building the sides, nail the 6-inch bottom side board to the end uprights a sufficient distance from one end to allow for clearance of the skid and the floor (3½ inches). Now measuring from the floor level, the second board is nailed on 7 inches up, the third 12 inches, the fourth 24 inches, the fifth 42 inches, and the top board flush with the ends of the uprights.

Additional Uprights and Braces

A short (19½ inch) upright is nailed across the skid and three lower boards 1 foot 7 inches from the rear. A second brace is nailed in a similar manner 2 feet from the front end and directly opposite the place where the stanchion is to be built inside the crate. The 4 foot 1 inch uprights are nailed vertically in the center of each side, the lower end covering the third board from the bottom, and the upper end coming flush with the top of the crate.

Two diagonal braces 6 feet 2 inches long on each side, extending from the top to the bottom, give added strength and rigidity.

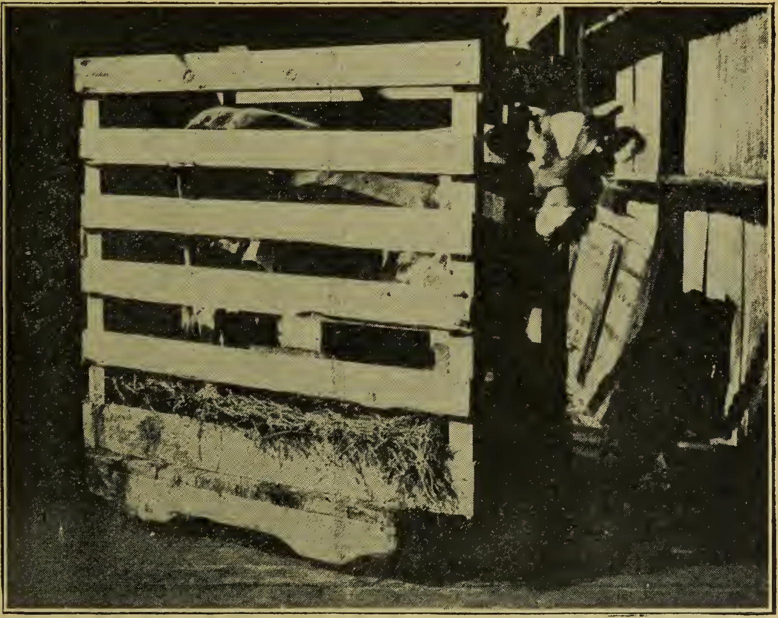

FIG. 9—A DANGEROUS CRATE.

The cattle crate should be so designed as to protect the head of the animal.

Head End of Crate

In putting the crate together first nail the two sides to the floor. Three slats 3 feet 6 inches long of 1x4-inch lumber should now be cut. At the closed end, the slats are nailed on opposite the three uppermost side bars. A 6-inch slat is nailed across the bottom so that the completed crate has a 6-inch bottom board on two sides and the front end. A diagonal brace is nailed inside the front end.

The top of the crate consists of three slats—one at each end and a third across the middle, directly over the uprights on the sides. A long diagonal brace on top aids in giving stiffness to the crate.

Making the End Gate

The end gate on the cow crate is similar in construction to that on the sheep crate. Two 1x4 uprights are cut 4 feet 10 inches long. The four cross-pieces are of the same length as those on the front end; one of the cross-pieces is made of 2x4-inch lumber to hold the hinges. They are placed at the same intervals as the side boards. Nail the uprights onto the bars, allowing a 2-inch margin on either side, and clinch the nails. The uprights are on the inside when the gate is in position. A hinge clasp on either side locks the gate in place. A diagonal brace is also nailed on the inside of the gate between the two perpendiculars.

A 3-inch slat nailed across the top at the end and a 4-inch slat on the bottom help to hold the gate in place. Notches are cut in the end slat on the top of the crate to receive the perpendiculars.

Building the Stanchion

The crate is now ready for the stanchion. Just 2 feet 2 inches from the bottom bar at the front end of the crate draw a pencil line across the floor. Cut two pieces of 2x4, long enough to fit snugly across the crate. These cross-bars are placed on edge 2 inches apart and held by small blocks nailed to the side of the crate. Two blocks on each side are sufficient for this purpose. A small piece of 2x4 is placed between the two cross-bars.

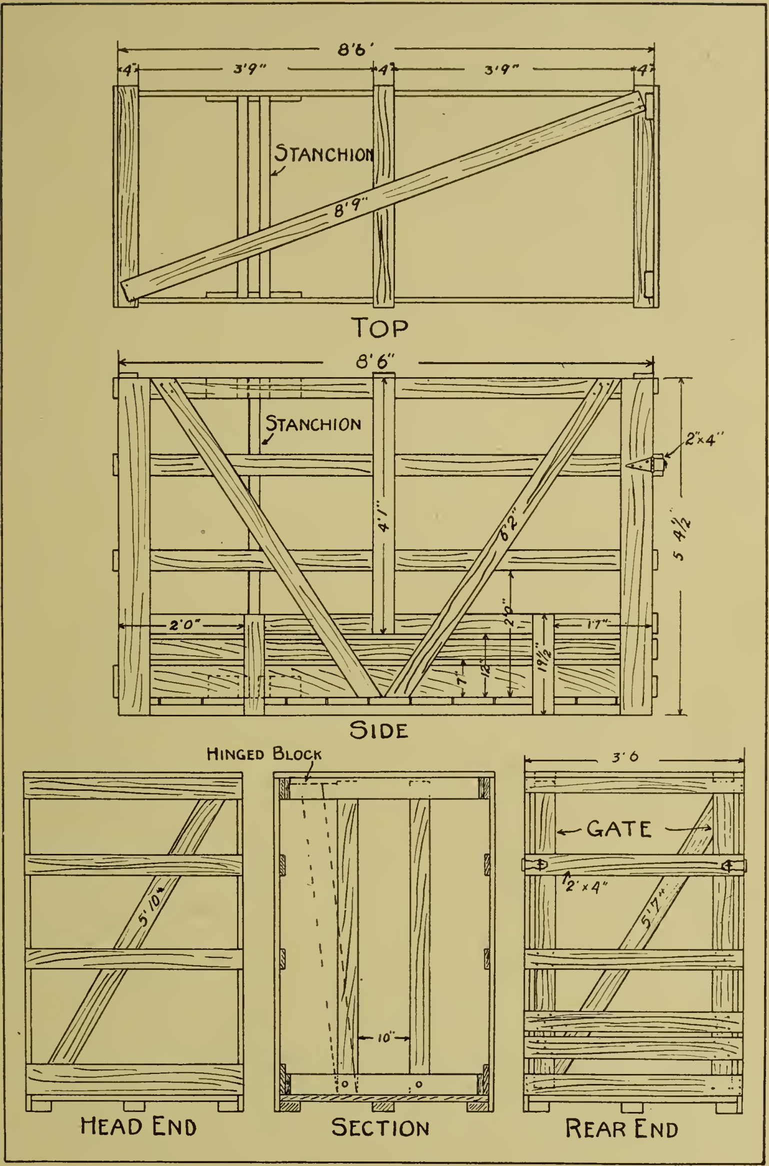

FIG. 10—WORKING PLANS FOR THE COW CRATE.

In the same manner put two 2x4 pieces between the top slats. The stanchion is built between these holders and consists of two 2x4s bolted at the lower end 10 inches apart. A hinged block between the top bars on one side of the stanchion allows it to be opened and closed.

PARTS FOR THE COW CRATE

Head End—	
3 slats	1"x4"x3'6"
1 slat	1"x6"x3'6"
1 diagonal	1"x4"x5'10"
Sides—	
4 uprights	1"x6"x5'4½"
2 uprights	1"x4"x4'1"
4 short uprights	1"x4"x1'7½"
4 diagonals	1"x4"x6'2"
10 slats	1"x4"x8'6"
2 slats	1"x6"x8'6"
Floor—	
2 skids	2"x4"x8'6"
1 cleat	2"x4"x6'6"
Floor boards	1½"x6"x3'4"
Total length of floor	8'6"
Top—	
3 cross-pieces	1"x4"x3'6"
1 diagonal	1"x4"x8'9"
Rear End—	
1 bottom slat	1"x4"x3'6"
1 top slat	1"x3"x3'6"
Gate—	
1 diagonal	1"x4"x5'7"
2 uprights	1"x4"x4'10"
3 slats	1"x4"x3'6"
1 slat	2"x4"x3'6"
Stanchion—	
4 cross-bars	2"x4"x3'2"
2 stanchion bars	2"x4"x5'0"

Care of Crates

The durability of livestock shipping crates will be greatly increased if proper care is given the crate when not in use. Tests conducted by the Forest Products Laboratory show conclusively that the holding power of nails is decidedly decreased with alternate wetting and drying of wood. To prevent this, crates should be kept inside covered sheds when not in use. Following each trip, crates should always be cleaned out. Whether stored indoors or out, crates should never be left setting on the ground.

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New Clothes at Small Cost

* * *

Extension Service of the College of Agriculture
The University of Wisconsin

To Save Clothing

Know what you can spend, think over your needs, and keep accounts.

Repair, remodel, care for clothes, and wear out old clothes.

Cut your wardrobe to the minimum.

Select material according to its value and appropriateness.

Choose garments that harmonize.

Buy well-made simple garments that will need few repairs and stay in fashion.

Be a considerate shopper; carry home packages; pay charge accounts promptly; return goods quickly and in good condition if they are not wanted.

Select clothing that will keep the body clean, dry, evenly and moderately warm, unhampered, and well ventilated.

New Clothes at Small Cost

HAZEL MANNING

TAKE AN INVENTORY of the family wardrobe some day and see what can be done with the clothes that are no longer fit for wear in their present condition.

A surprising number of ways to make over these garments will suggest themselves. There will be some shirts with worn places around the neck, some waists with holes under the arms, worn night gowns and other white garments which always have a wealth of possibilities. Certainly there will be some woolen garments.

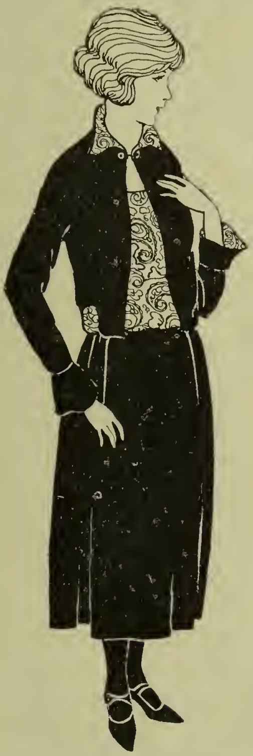

FIG. 1—A DRESS MADE FROM A SUIT

Green broadcloth effectively combined with figured silk.

Making Over Dresses

Old clothes should be thoroughly cleaned and pressed before being made over. Frequently two garments can be combined to excellent advantage. Good judgment should be exercised, however, or the wearer will soon become displeased with the garment and cast it aside, thus wasting both the work and the material required to make it. As a rule silk is combined with silk and wool; and cotton with cotton, wool or silk.

To dress well is an art and requires careful thought. The artistic woman is one whose clothes have beauty and individuality, whether she is stout or slender. Comfort is the first requisite, for if comfortable clothing is worn, one is apt to be natural and easy in manner.

The very stout woman should consider only designs with long slendering lines, a comfortable fit, and solid colors. Stripes, plaids and figures of any kind attract attention to dimensions.

The thin woman may soften the lines of her figure with comfortable fitting garments made of material which does not cling. It is not always wise to use too many cross lines, for often they divide the garment into small spaces which attract attention.

Color in the costume is essential. The young person needs to give but little care to the use of color, but as one grows older it is necessary to adapt costume, line and color to the demands of each year's alterations in the individual.

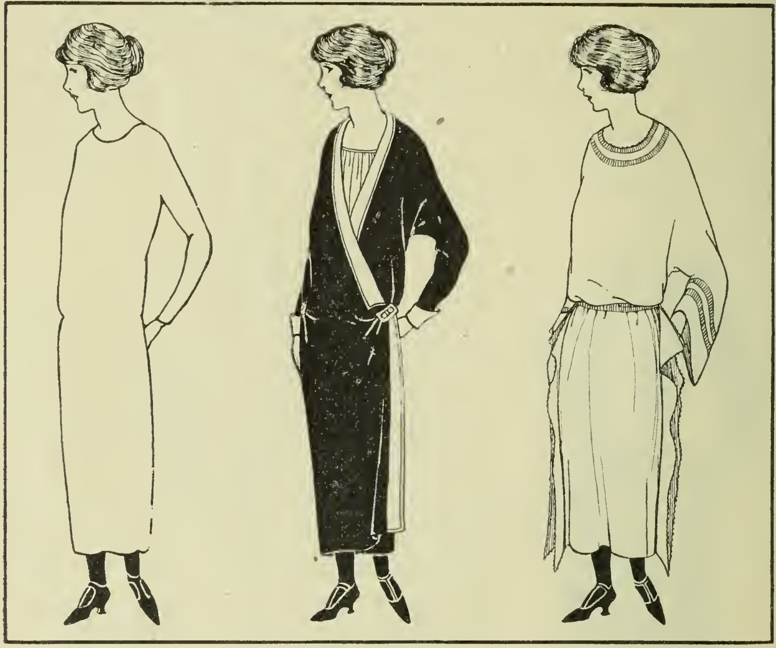

FIG. 2.—THE SLENDER FIGURE NEEDS BROADER LINES

Slender figure Effect of long lines Effect of full draperies

Suggestions for Made-Overs

Military style for the worn woolen skirt. Military braid is good to use in making over an old woolen skirt. After the belting and hem have been removed, the skirt is washed, pressed, and turned wrong side out, and the raw seams are covered with military braid. Thus a two-, four-, or five-gored skirt may be made attractive without the work of turning all the seams.

The old white skirt. If the white skirt of three summers ago is not in style, there are several ways in which it may be used. It can be drawn up to the shoulders and a Russian blouse, a style which is always worn, may be made of it. White materials are not very hard to combine, so if the skirt does not furnish enough cloth for sleeves, collar, cuffs, and belt, new material may be purchased. A way to make a tight skirt wider is to draw it up until it is full enough about the hips and then let out the hem or put on a false hem of new material. Another suggestion is to put a yoke on at the top and wear the skirt with a long blouse of dainty tissue gingham, which is always fresh and cool-looking. A faded summer dress of lawn might be dyed and used for a blouse.

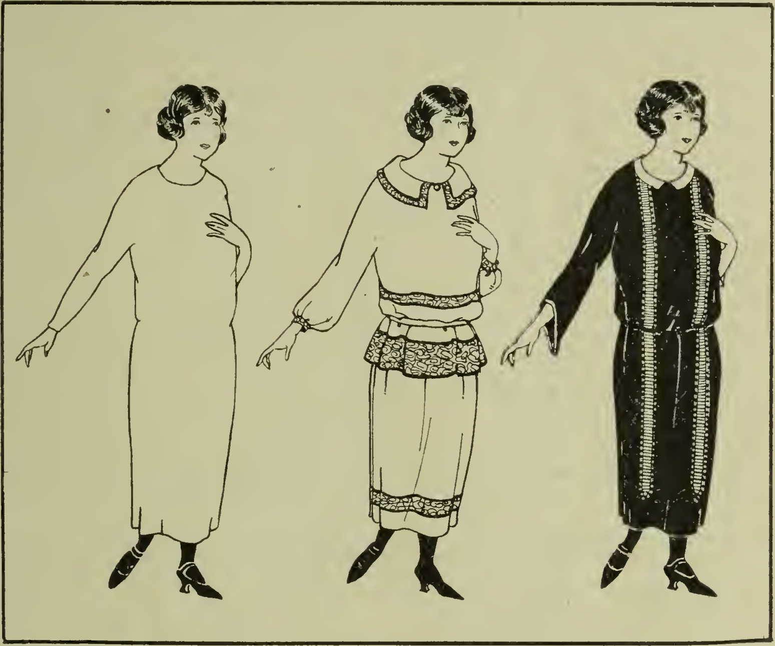

FIG. 3.—THE STOUT FIGURE NEEDS LONG LINES AND SOLID COLORS

Stout figure Effect of cross lines Effect of long lines

Cutting down for the children. Women's garments are frequently cut down and used for children's clothes. A woolen suit may be altered to fit a girl of 15 to 18 years without much change save a fresh facing for collar and cuffs. New collar and cuffs often make an old suit look new; there are always left-overs which may be used for this purpose.

Coats and dresses for little girls may be made from partly worn skirts. Figure 4 gives an idea of how a child's coat or one-piece dress may be cut from a partly-worn five-gored skirt. Figure 5 shows how a heavy serge skirt may be made into a whole suit for a little boy.

Just a word here about using the dull colors of a woman's suit for a little girl's dress. Be sure to brighten up sister's frock with a touch of gay plaid or plain material in a bright color.

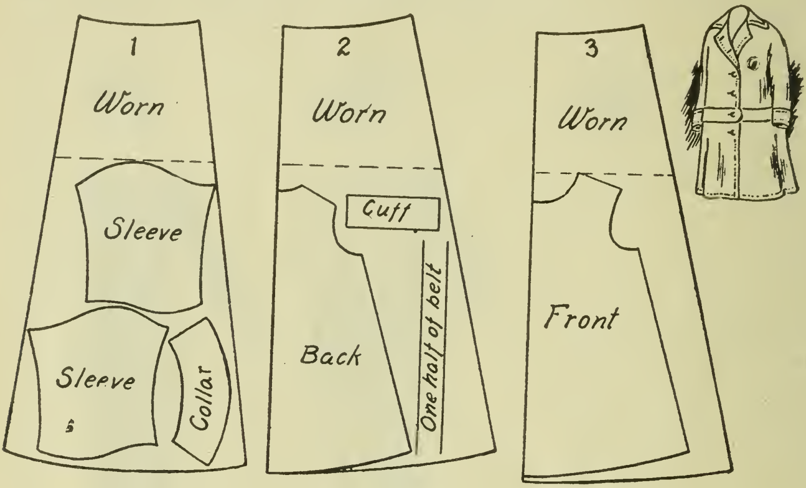

FIG. 4.—A "NEW" COAT

Arranging the pattern in this way allows the cutting of either a one-piece dress or a little coat from a five-gored skirt.

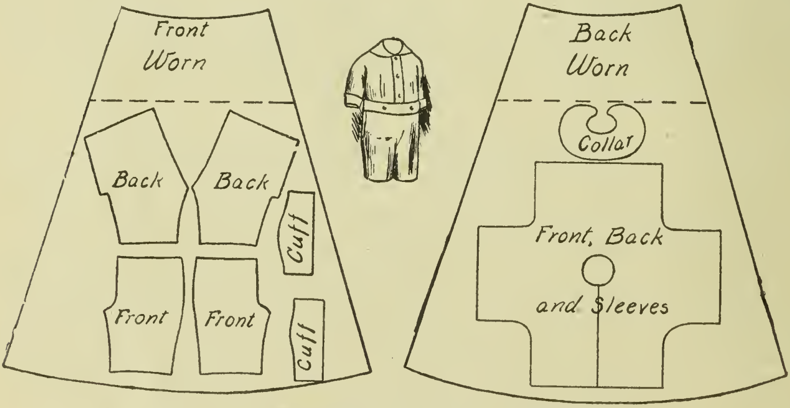

FIG. 5.— A GOOD SUIT FOR A LITTLE BOY

This suit costs nothing except the time required to make it.

Making dresses from suits. Old suits can be made into one-piece dresses. The lining is removed and the seams of the body and sleeves are taken in somewhat. If silk or other soft materials are used in combination with the suit material the too-tailored effect is relieved.

Making over underwear. Both muslin and knitted underwear may be cut over if it has not been too much worn. There is not much wear on the ruffle of a woman's cotton petticoat and this will often make the whole skirt for a child. A good quality of lace or embroidery nearly always wears longer than the garment and may be used again.

Knitted underwear (Fig. 6) may be cut down for both boys and girls. Seams should be made as flat as possible and the neck, bottom, wrists and armseyes may be finished first by stitching on the machine, back-stitching or binding. A shell crochet or a blanket stitch may then be used as a final finish. This is easier than making a hem.

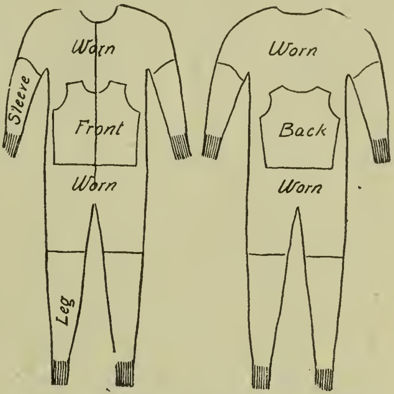

FIG. 6.—UNION SUITS FOR THE CHILDREN

Father's and mother's underwear may often be made over for the little people.

A new way to foot the stocking bill. Stockings should not be thrown away

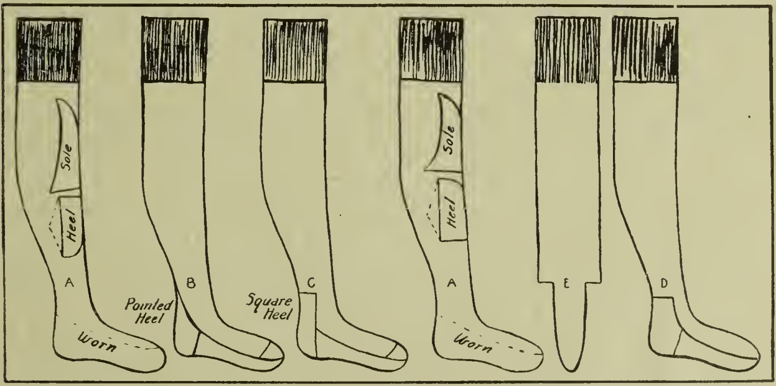

FIG. 7.—MAKING NEW STOCKINGS FROM OLD ONES

These methods of re-cutting double the lifetime of a pair of hose.

because the feet are worn out. New feet may be cut from old uppers. Sometimes new stocking feet can be purchased. Children's stockings may be cut from the leg parts of women's hosiery.

One ingenious mother sews the tops of two stockings together and draws them on her creeping baby. In this way the underclothing is kept clean much longer. The closely woven tops of father's or big brother's socks make splendid wristlets for the small folk when skating is good. The folded leg of a long stocking makes a first-rate holder for use in the kitchen. Fold into the desired size and shape, overcast about the edge or even button-hole it and then quilt a few times and you will have a useful article.

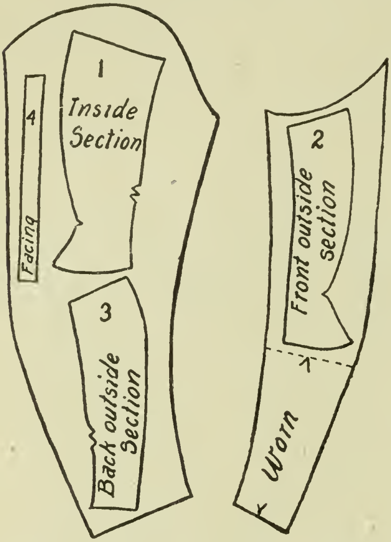

FIG 8.—LEGGINGS FROM WOOLEN SLEEVES

Children's leggings cut from a worn two-piece sleeve keep out winter weather as well as new ones would.

Making leggings for children. On wintry days the children's legs will be kept much warmer if they wear leggings over their stockings. These can be made from two-piece sleeves of a woolen dress or coat.

Using the men's old clothes. Men's clothing may be cut over into smaller garments. Overcoats make good topcoats for either the small boy or girl or even a whole suit for a boy.

Undergarments, especially woolen ones, may be easily made over for children. The lower part of a good woolen shirt will make a warm petticoat for a child.

"The tale of a shirt." The story of the things that can be done with a partly worn shirt is a long one. In this day of gayly striped madras, the lower part may be used to make a dress for a little girl or a blouse for a small boy.

Even mother can make a shirtwaist for herself by using plain white material for the collar and cuffs. It will be necessary to finish the lower part with a belt or peplum since there will not be enough material to extend below the waist line. The sleeves may also have to be shortened.

The little touches. Bias bands for trimming plain colors can be cut to very good advantage from shirts. Pretty collars and cuffs for plain dresses or suits may also be cut from these partly worn garments.

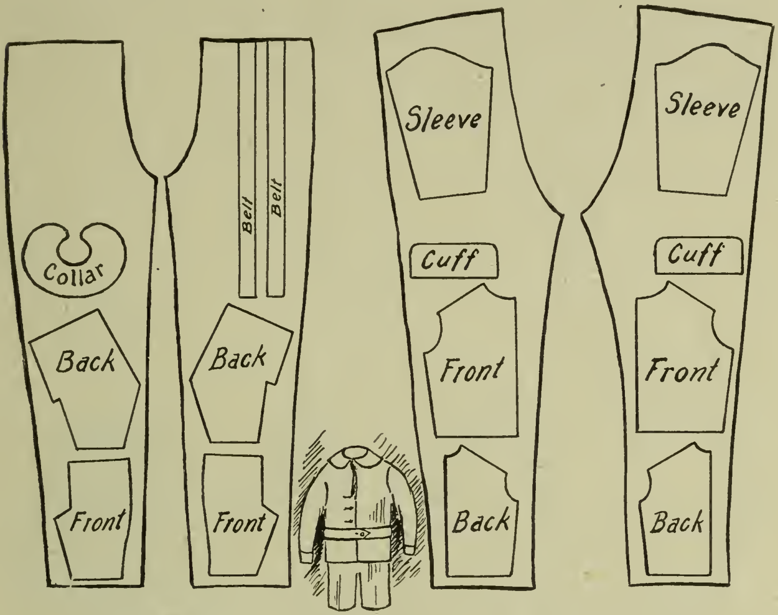

FIG. 9.—MEN'S OLD SUITS SHOULD NOT BE DISCARDED

Two pairs of boys' trousers or one pair and a small coat may be cut from men's partly worn trousers.

A small, round apron for mother or a little sleeveless apron for sister, to be worn after school and at meals, may be cut from the tail of a partly worn shirt with very little trouble.

Using the silk shirt. Striped silk always makes pretty collars, cuffs, and belts as well as bias folds and facings for plain materials. A silk shirt lends itself well to these uses.

Trimming the made-over garment. Embroidery in wool and silk is a good way to brighten a rather sober gown and may often be used to cover piecing in the waist. The arrowhead is used a great deal on dresses and coats. These simple directions may aid:

Outline arrowhead with pencil, chalk or thread. Run needle through center to point A in order to fasten thread without using knot.

Take up one thread of material at B, stitch down at C.

Take a stitch from C to A, on the wrong side.

Again place needle in material at B.

Again take stitch from C to A.

Continue until entire triangle is filled. Each succeeding stitch at B is longer and each stitch is worked toward the line AC. (See drawing of wrong side of arrowhead.)

Each stitch on the line AC is shorter, but is always placed on the line AC.

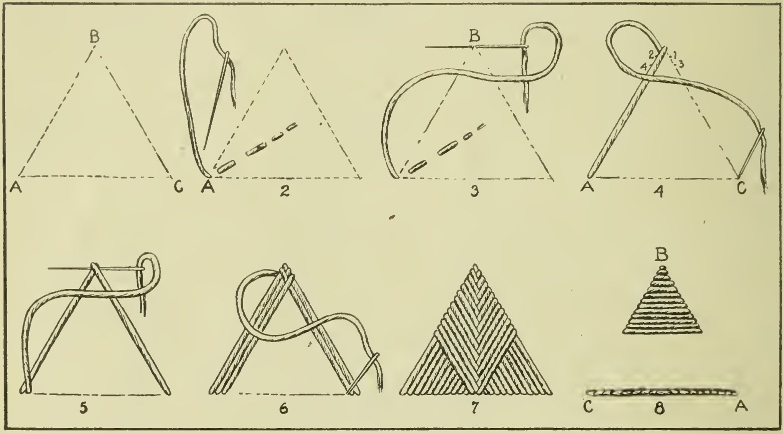

FIG. 10.—THE ARROWHEAD IS AN EFFECTIVE TRIMMING
Used at the ends of pockets and tucks or to hold the inverted pleats in place, this is one of the "little touches" that count.

Clusters of pin tucks make a very pretty trimming and may be used in the skirt to cover piecings in both cotton and woolen materials. Woolen dresses may have two or three groups of pin tucks in the skirt, in the waist, and in the sleeves, from elbow to wrist. Rows of narrow braid make a dressy trimming. Narrow pleatings of silk in a contrasting color about the neck and cuffs of an old dress will make it look fresh. Fringe of silk in tones which match the material may be used over both the waist and skirt to hide piecings and give character to the costume.

Combining new materials with old. It is often necessary to buy some new material to combine with the old in making over clothes. A woolen dress may need new sleeves. Satin or plaid or striped taffeta may be used. The silk should always have at least one color in common with the woolen material.

Preparing New Material for Use with Old

Shrinking. Place the white cotton or linen material in hot water for 10 to 15 minutes. Dry, and then sprinkle and iron, or fold when almost dry and then iron.

Place over the material a piece of cheesecloth which has been wrung out of water. Press until the material is dry. (For wool.)

Wring a sheet out of water, then place the cloth in the sheet folded once lengthwise in this manner: first, a layer of wet sheet, then a length of material, then the other half of the sheet, then the remainder of the material. (Best home method of shrinking wool.)

Pass steam through the cloth and then press. (Commercial method.)

Giving the sewing machine a chance. Just as the skilled mechanic obtains best results in his work when he cares for his machines properly so will the housewife find that her sewing machine will do better work if it is cared for and kept in good running order. Some of the ways to make the sewing machine do better work are:

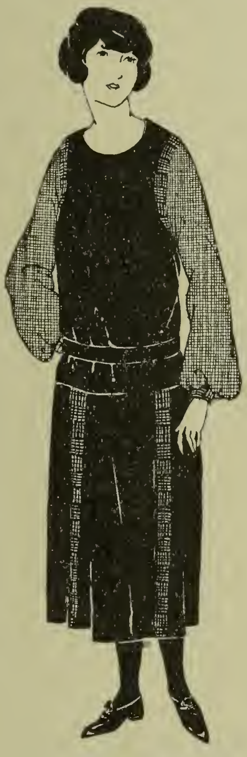

FIG. 11. — A NEW DRESS FROM AN OLD SUIT

A change in cut and the addition of silk.

Oil wherever there is friction. In most cases such places are indicated by oil holes. Poor oil gums the machine and makes it run hard. To remove poor oil from machine, oil with wood alcohol and run it a few minutes with the needle unthreaded. Wipe off the excess, and oil with a good machine oil.

Use only needles made for the machine you are using. Be sure that needle is firmly set and that the slot in the needle is toward the outside of the needle bar.

To keep the needle from unthreading raise the needle take-up to the highest point before removing cloth.

When removing the cloth pull the thread under the presser-foot backwards. When the thread is pulled forward the strain bends the needle.

Do not pull the goods while stitching.

Cloth puckers if the tension above or below is too tight or if there is too little or too much pressure on the pressure foot. If the material is very thin it is well to use paper under it.

If the stitch skips it may mean that the needle is bent, incorrectly set, or too fine for the thread.

When the upper thread breaks it may be that the machine is not properly threaded, that the needle rubs against the presser foot, is incorrectly set, or is the wrong size for the thread, that the needle eye is sharp or rough, that the point of the needle is bent or broken, or that the upper tension is too tight.

If the lower thread breaks it may be that the bobbin is too full or unevenly wound or the bobbin case is not correctly threaded.

Do not cast aside the attachments. You will find the ruffler and pleater of value in making trimming for clothing as well as for household decorations. The tucker may also be used in making trimmings for clothing. The hemmer may be used on certain rufflings or clothing and even on tablecloths and napkins, now that we are obliged to use union or even all-cotton materials for table linen.

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January, 1923

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Sewing For Girls

EXTENSION SERVICE OF
THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN
MADISON

CLOTHES FOR GIRLS

APPROPRIATE and becoming clothes mark the well-dressed girl. Her garments are simple, modest, attractive, and suitable. The lines of her clothes harmonize with those of her face and figure and the colors of her garments are suited to her eyes, complexion and hair.

The well-dressed girl buys the best material she can afford, makes her clothes simply and well, and cares for them intelligently after they are made.

Sewing for Girls

GERTRUDE ARBOGAST

THE GIRL who can make her own clothes is not only saving money but she is also learning to adapt materials, color and style to her own particular needs. It is this ability to make the clothing emphasize rather than hide the personality that marks the well-dressed woman whether her garments be costly or inexpensive.

Well-made, appropriate clothes can be made at home for about one-fourth the cost of ready-made garments of the same grade, but the difference in cost must be made up in the time and energy spent in sewing. Most girls have spare time that they can use to advantage providing they are patient and persevering in learning the fundamentals of good sewing.

The first dress that the girl makes for herself may not look quite so good as that made by an experienced seamstress but skill will come through constant practice.

THE WORKBOX

Here are the things every girl needs in her workbox:

- Thimble (celluloid is best)
- Package of needles, 5 to 10 Sharps
- Paper of pins number BB
- Tape line, 60 inches in length with numbers on both sides and a number 1 at each end
- White thread numbers 70 to 90
- Emery bag
- Small pin cushion
- A pair of sharp shears with not less than a three-inch cutting blade

SUGGESTIONS FOR SEWING

Sit with both feet on the floor with the light falling over the left shoulder.

Bring the work to your eyes, not your eyes to the work.

Use scissors to clip your thread. Biting it may crack the enamel on your teeth, soil your work, and spread disease germs.

Make all permanent stitches small and even, and have the wrong side as neat as possible when finished.

Use a short thread for sewing; it should be as long as the distance from shoulder to shoulder or from finger tip to elbow. Basting thread may be longer.

To prevent cotton from kinking, thread the needle before breaking the thread from that on the spool.

A knot is used only in basting or when it can be hidden.

Never cut notches in the cloth to correspond with those in the pattern. Mark the places where they should be with pins inserted perpendicularly to the edge of the cloth, or by running a thread in material where a notch should be.

Wash your hands before beginning to sew.

Always wear a thimble that fits the second finger of the right hand.

Wear a sewing apron.

When you stop sewing, put the needle in the case, fold your work neatly and put it in the sewing box.

Handle the work as little as possible. If your hands perspire, dust them lightly with cornstarch or talcum powder.

When using pins to hold two pieces of material together before basting or sewing place them at right angles to the sewing line.

PLAIN STITCHES

Even Basting Stitch.—This stitch is used to hold two edges together while they are being permanently sewed. It is not so strong as an uneven basting. The stitches are the same length on the wrong and right sides.

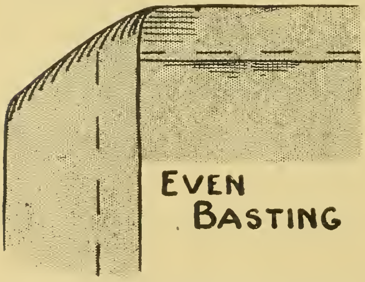


Fig. 1.—Even basting. Right and wrong sides.

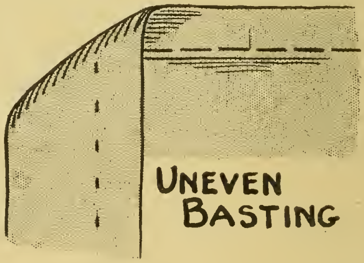


Fig. 2.—Uneven basting. Right and wrong sides.

Uneven Basting.—Used as a preliminary sewing to hold edges together. The stitches on the wrong side are about one-fourth as long as they appear on the right side.

Running Stitch.—Used chiefly for gathering. A succession of tiny stitches, usually made with a very fine needle and thread. Run six or eight small stitches on the needle each time before drawing the thread through. Note position of hands in Fig. 3. This stitch can be well done only by continual practice.

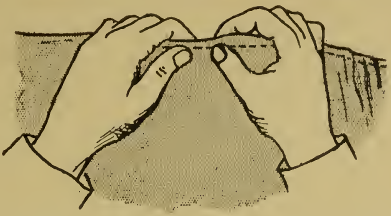


Fig. 3.—Correct method of holding the hands in making running stitch.

DECORATIVE STITCHES

Blanket Stitch.—This may be worked from left to right or right to left. Fasten the thread on the underside with a few running stitches, and bring out the needle at the point for beginning the blanket stitch. With the thumb hold down the thread, working from left to right or from right to left to form a U. Insert the needle above; bring it out under the edge of the cloth but over the thread held down by the thumb. This forms a loop. Be careful not to draw threads too tightly. Insert the needle the desired distance to the right of the last stitch; bringing it out as before. Make the stitches parallel. In turning a corner take three stitches in the same hole. Let stitches radiate from the hole with the middle stitch directly on the corner. Fasten on the underside with a few running stitches.

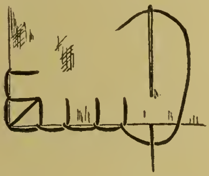


Fig. 4.—Blanket stitch.

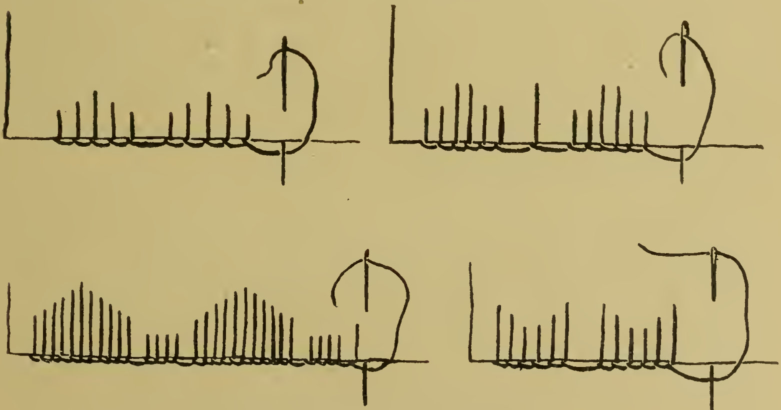


Fig. 5.—Blanket stitch variations.

Variation of Blanket Stitch.—Blanket stitch may be made into a more interesting decoration by varying the length of stitches as in Fig. 5.

Outline Stitch.—The outline stitch is made away from the worker and follows a line. Hold the work over the first finger of the left hand. Point the needle toward you. Keep the thread as it comes from the eye of the needle below the needle while taking the stitch. Insert the needle one stitch beyond the previous one and bring it out to almost meet the stitch just made. The length of the stitch will vary according to material and design. When a substantial line is needed, take stitches close together.

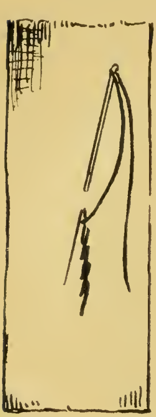


Fig. 6.—Outline stitch.

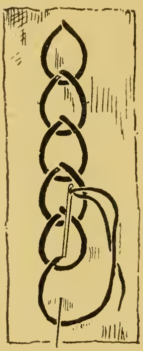


Fig. 7.—Chain stitch.

Chain Stitch. — Work toward you holding material over the first finger of the left hand. Begin with a few running stitches, bringing the needle out at the place for beginning the chain stitch. Let the thread hang down to form a U made from left to right and hold it in place with the thumb. Make a stitch pointing the needle toward you and bringing it out over the thread loop. Draw it through to form a loop or link of a chain, as in the picture. Hold the thread as before, and take the next stitch inserting the needle where it came up—just inside the previous loop. Continue making stitches regularly. In fastening, push the needle through just below the thread of last loop in order to catch it. Fasten on the under side. If the thread is to be joined, begin as before by bringing the needle up through the last loop and continue. This stitch is used for outlining and other decorative purposes. It is also used for padding designs that are to be embroidered.

Feather Stitch.—This is somewhat like the chain stitch, but in the single variety it is formed first to the right and then to the left of a line and is not a finished link but forms a V. In starting take a few running stitches bringing the thread out at the place for beginning. Let the thread hang down as for the chain stitch, hold it with the thumb and, in taking a stitch, insert the needle the length of one stitch to the right and bring it out the length of one stitch directly below and on the line you are following. The needle should point toward the left shoulder. Draw the thread up to form a V. In making the next stitch, throw thread from right to left so as to form a U in the other direction. Insert the needle one space to the left of the line, and bring it out one space below the other stitch and directly on the line. The needle should point toward the right shoulder. Briar stitch is made by making two or three stitches on the right side, then two or three to the left of the line.

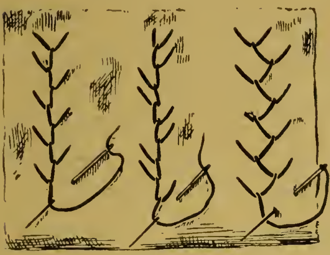


Fig. 8.—Feather stitch.

The beauty of the feather stitch is in making the stitches regularly to right and to left. Variation of it may be made as shown in Fig. 8. The feather stitch makes a very effective trimming, and is used for outlining designs, and for finishing hems and seams on both underwear and outer garments.

Cross Stitch.—This stitch forms a series of tiny crosses, and is one of the simplest forms of embroidery. If the material used has a coarse weave with the same number of threads to the inch both ways, as Java canvas, scrim or Hardanger cloth, the threads of the material will serve as a guide. On finely woven materials it is best to baste on cross-stitch canvas and work the design over it.

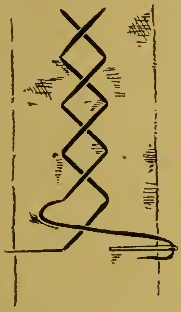


Fig. 9.—Cross stitch.

In making the cross stitch, begin at the top and work toward you. Bring the needle out at the lower left-hand corner of a square. Insert the needle in upper right-hand corner and bring it out in the upper left hand corner. This makes a slanting stitch on top and a horizontal one underneath. Insert the needle in the lower right-hand corner and bring it out in the lower left-hand corner. This makes a slanting stitch on top of the first one, completing one cross stitch, and bringing the thread out ready for next stitch. If there is a long line of stitches to be taken, it is quicker to make all the stitches going in the same direction first, then come back and cross them all at the same time. Be sure the crosses meet at the corners. When working on canvas, draw the threads tightly, so that when the canvas is removed the thread will not be loose. When the design is completed, soften the canvas by rubbing it between the hands, or dampen slightly and remove the threads one at a time.

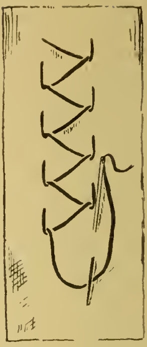


Fig. 10.—Coral stitch.

Coral Stitch.—This is really a variation of the feather stitch made by inserting the needle vertically instead of slanting. Work toward you following two lines of marking. The uses of the coral stitch are the same as those of the feather stitch.

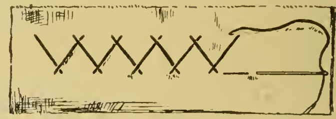


Fig. 11.—Catch stitch.

Catch Stitch.—This stitch is made going away from the worker. Begin at the left and follow two lines of marking. Take each stitch with the thread thrown to right of back of the needle, and hold the needle horizontally, pointing to the left. Pick up a few threads of material and do not draw too tightly. This stitch is used to finish flannel seams and hems, and to fasten down linings.

Hemstitching.—Decide on the width of the hem before any threads are pulled; allow twice the width of the hem plus enough to turn in. Draw one thread at a time the entire length of the hem. The number drawn will depend on the materials used. Wide hemstitching is customary for heavy materials and a rather narrow drawn space for the finer fabrics.

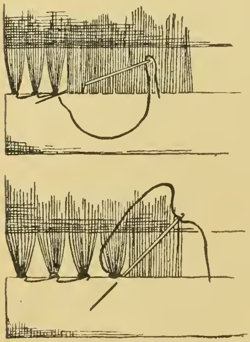


Fig. 12.—Hemstitching.

After the threads are drawn, baste the hem in position so the edge comes just to the open spaces. Work on the wrong side either to the right or left. The illustration shows work done from left to right. Hold the work over the first finger of the left hand; run the needle through the edge of the fold from right to left and fasten with a tiny stitch. Insert needle from right to left under the drawn threads, picking up the desired number. Bring the needle out without catching the hem. Pull firmly so as to keep bunch of threads distinct. Just below this stitch take a short one in fold of hem as shown in illustration. If desired, the open space may be hemstitched on both sides to form double hemstitching.

Eyelets.—Make a row of running stitches around the outline of the eyelet; if it is small, use a stiletto or orange wood stick to punch the hole. Pierce it until the opening is as large as the outline. If the eyelet is large, after running a thread around the outline, cut the material crosswise and lengthwise within the circle with a pair of embroidery scissors. Turn the slashed portion under until only the outline thread is visible. Work the edge with overhand stitches taken close together. To fasten the thread, take three stitches but do not pull them up; run the needle and thread back through these loops, then pull up one at a time in the order in which they were made. Draw the thread tight and clip it.

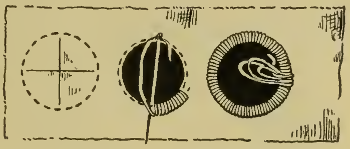


Fig. 13.—Eyelets.

Applique.—This is a very easily made and an effective decoration. Cut the flowers or the figures from cretonne, or other materials, baste them on the garment, and blanket stitch with strand floss, threading three strands in the needle at once. Keep the blanket stitches of uniform depth. If the stitches are placed close together, the edges of the figure need not be turned in. Many commercial companies have patterns for applique which may be bought. However, simple little four and five petal flowers and leaves are easily drawn or copied. Use outline stitch for stems and veins.

Smocking

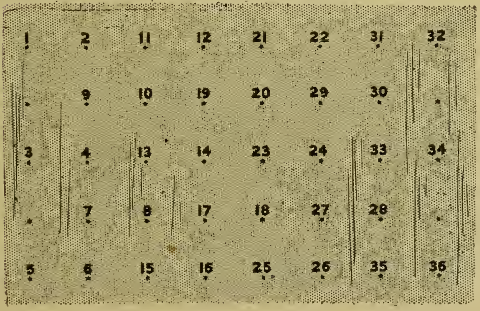


Fig. 14.—Dots placed for plain smocking.

Bring the needle up at dot 1, with two stitches, one over the other, join to dot 2, carry the thread under to dot 3, and join to dot 4, from joining 5 and 6 carry thread to 7 and 8, and follow joinings in consecutive order.

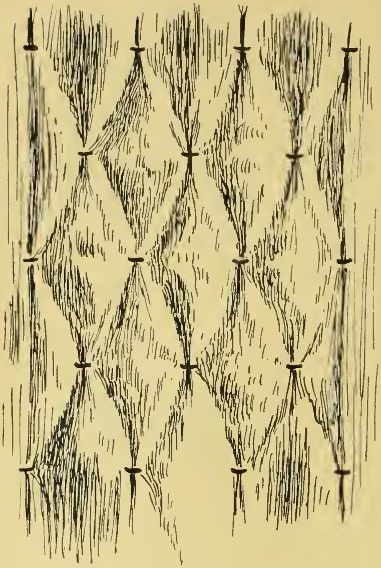


Fig. 15.—Plain smocking finished.

The dots for smocking may be placed from one-fourth inch to three-fourths inch apart, depending on the garment and material used. The finer the material, the closer together the dots should be. Use a ruler to mark off the dots.

Gathered smocking.—Different arrangements of dots will produce different patterns. It is a good plan to mark the line of the design very lightly with a lead pencil. If it is very sheer material and the mark apt to show, it is better to run a basting thread around the design. If small checked gingham is used, the checks may be used instead of dots. In allowing for smocking about twice the length which the finished piece is to be is required.

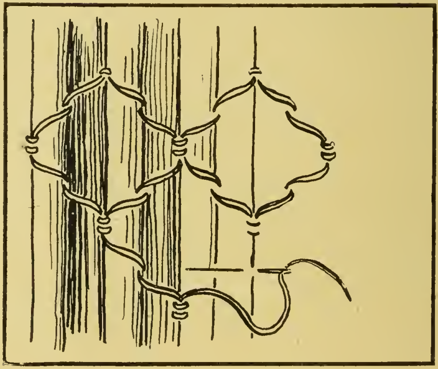


Fig. 16.—How stitch is worked.

Bring needle up through material at first dot, take a small stitch at second dot, with point of needle toward first dot (see Fig. 17).

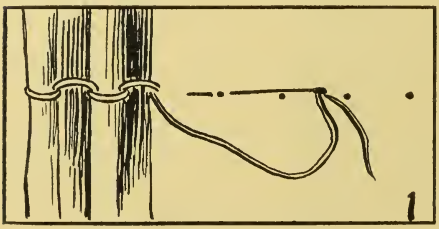


Fig. 17.—Detail of first stitch.

Always pull the stitch up tightly, forming a little pleat. For the second row, if at the start

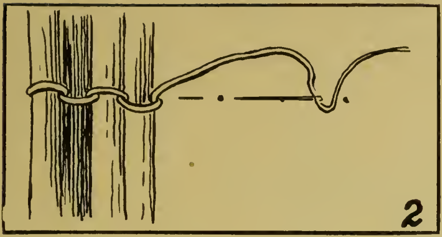


Fig. 18.—Detail of second stitch.

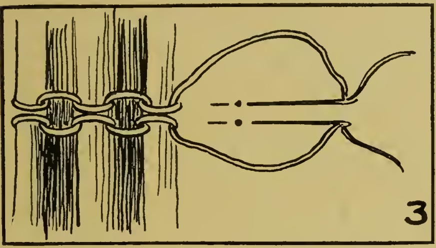


Fig. 19.—Cable stitch finished.

of the first row, the thread was below the needle, throw it above when starting the second row. If these two rows are close together and properly done the effect will be like a heavy chain. This is called cable stitch.

Gathered Smocking Stitch.—Bring the needle through the material on dot 4. (Fig. 20.) Connect it with dot x, making a little short stitch and pulling up tightly, then bring the needle through from the wrong side at dot 5, connecting this dot with dot y. Follow the line of the pattern, always connecting the dot with the dot to the left of it. When the top

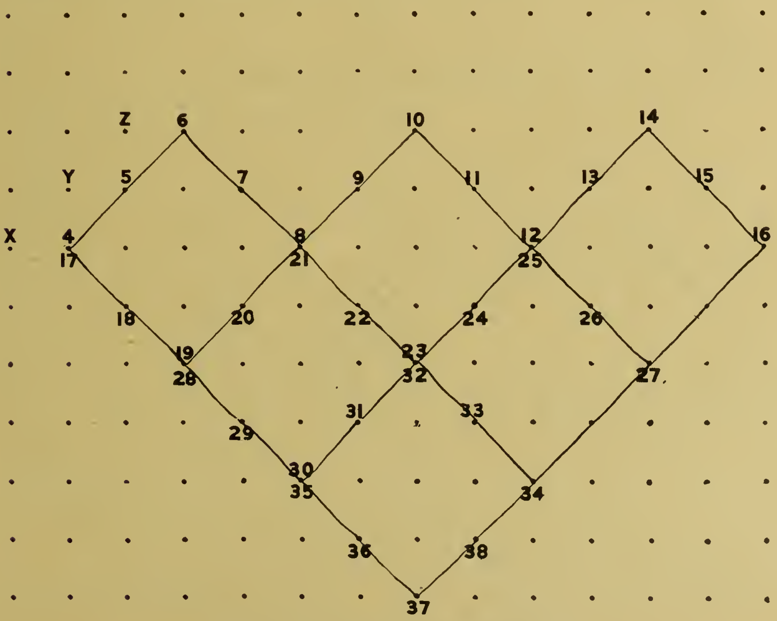


Fig. 20.—Diagram for smocking.

row is finished begin at dot 4 again and make the next row. Make rows of dots, as for plain smocking, from one-half inch to three-eighths inch apart.

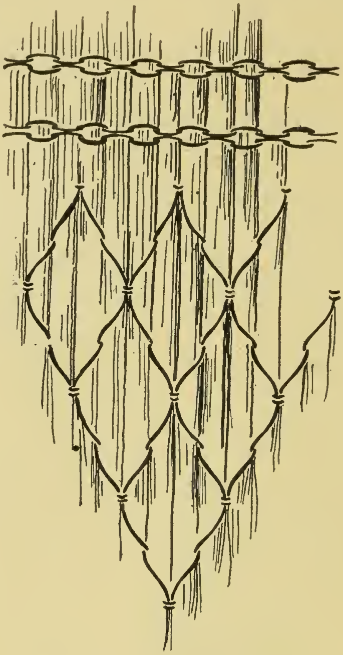


Fig. 21.—Pattern finished.

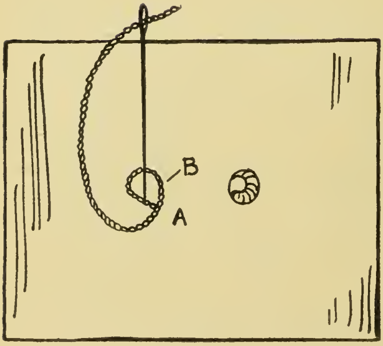


Fig. 22.—French knot made by wrapping thread once.

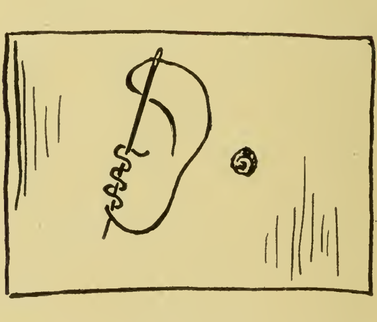


Fig. 23.—French knot made by wrapping thread more than once.

French Knots.—Bring the needle up from underside of material at point A. With the left hand hold the thread quite firmly between the thumb and first finger about an inch from the cloth. Wind the thread around the needle several times, depending on the size of the knot desired, and still holding the thread securely with the left hand, place the point of the needle back in the cloth at B, draw the needle through to the wrong side of material, and fasten thread. If very coarse thread is used, a good French knot may be made by winding the thread around the needle once.

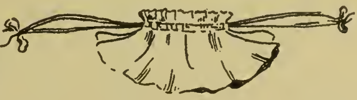
Sewing Box.—The best receptacle in which to keep sewing is a covered box, because the article is not so apt to become rumpled or dusty when it is not in use.

Sewing Bag.—However, one should always have a pretty bag to carry sewing, when visiting friends and for this purpose nothing is nicer than cretonne or chintz, which may be had in an endless variety of color combinations, and may be bought in any store. Linens, ginghams, Indian head, silk of various sorts, also make attractive and durable bags.

A very attractive bag is made as follows:

Take a piece of material 24 inches long and 18 inches wide. (Fig. 24.) Hem the short ends if they are not selvage with very narrow hems. On the long edge turn and baste one-half inch hems. Hem by hand.

Fig. 26.—Finished bag.



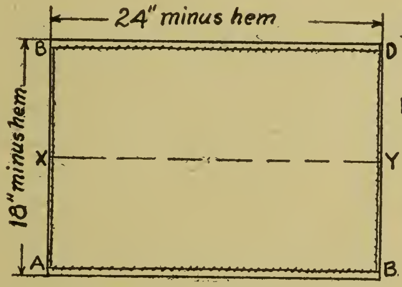


Fig. 24.—Material for sewing-bag.

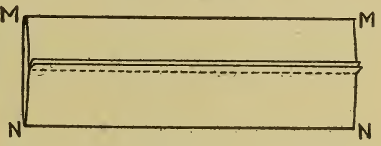


Fig. 25.—How to fold material.

Crease and run a basting line through center for a guide.

Fold material over with points A and B meeting at X and B and D at Y. Overhand ends from M to N (Fig. 25) with very small stitches, allowing the one-half inch hems to stand up.

Insert ribbon in hem at A, run through and out at lower B, in at D and out at B. Start second ribbon lower B, run through and out at A, in at B and out at D. Tie small bows at end of ribbons and pull up bag.

SEAMS

There are three kinds of seams commonly employed in garment making, plain, felled and French.

The plain seam is stitched on the wrong side from three-eighths inch to one-half inch from the raw edge. It is pressed open, and the raw edges overcast, bound, or turned under once and stitched on the machine or by hand to prevent fraying. This type of seam is never used in wash garments unless the material is exceedingly heavy, and then the raw edges are bound.

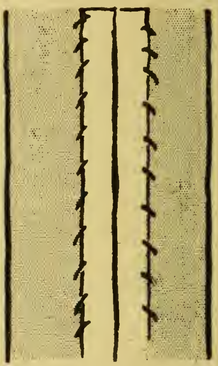


Fig. 27.—Plain seam overcast.

The felled seam is used in making underwear, middies, men's shirts, women and children's plain semi-tailored clothes. It is a good seam for rather heavy material since it irons very well. When used for underwear, both rows of stitching are done on the wrong side, but for outer garments usually the stitching is done on the right side of the garment.

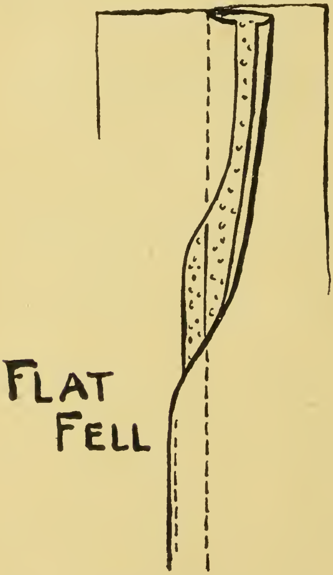


Fig. 28.—Steps in making a flat-fell seam.

To make the seam—baste and stitch one-half inch from the edge. Trim off one seam edge to one-eighth inch width, flatten down the other side, turn the edge under and baste, then stitch. This seam should never be wider than one-fourth inch finished and in underwear may be narrower.

The French seam is perhaps the most used of all. The first stitching is on the right side of the garment. After basting and stitching one-fourth inch from edge, trim both edges off to one-eighth inch. On the wrong side of the garment, run thumb nail along seam to prevent the seam from bulging, then fold, with first sewing on edge baste one-eighth inch to three-eighths inch from edge and stitch carefully. The width of this seam depends on the kind of garment and material. Heavy material requires a wider seam than lighter weight.

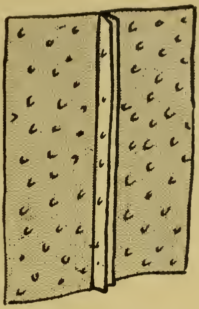


Fig. 29.—First sewing for French seam.

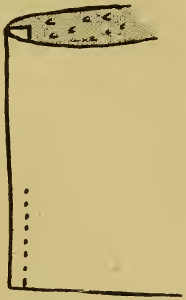


Fig. 30.—Second sewing for French seam.

BUTTONHOLES

A good buttonhole does not stand open when finished.

A buttonhole may be worked from right to left, or from left to right, but the double thread as it comes from the eye of the needle must be thrown around the point of the needle in the same direction in which the work is proceeding.

Buttonholes should always be made on double material on the right side of the garment. In women's garments they should be worked on the right hand side whether the closing is in the back or front.

Mark the place for buttonholes with a thread and only cut and make one at a time. To cut a buttonhole without using buttonhole scissors—fold the strip in which the buttonholes are to be placed exactly in the middle, and with the scissors make a very tiny clip with the thread of the material. Open the strip and insert the scissors cutting the buttonhole first one direction then the other until it is the desired length.

For a flat button, make the buttonhole as long as the diameter of the button. If the button is thick or nearly round, cut the buttonhole a little longer than the diameter.

Always work a buttonhole with a single thread. Enough thread should be threaded into the needle to complete the buttonhole. The slit should be kept straight and not pulled out of shape.

The depth of the stitches and spaces between them should be uniform. Generally speaking the stitches should be one thread apart and the closer the stitches the stronger the buttonhole.

It is best to practice cutting buttonholes on a strip of old material before cutting them in the garment.

Beginning at either end of the buttonhole, overcast the two edges together, using not more than three overcasting stitches on each side and one in each end. These stitches should be only about one-sixteenth of an inch deep, otherwise the buttonhole stitch must be taken too deeply to look well.

Working the Buttonhole.—Begin to work the buttonhole at the lower right or lower left hand corner. Bring the needle through at 1 taking the stitches four threads deep. Pick up the double thread at the eye of the needle, throw it under the point of the needle, from right to left or left to right, and draw the thread out straight so that the knot or purl comes at the edge of the cloth. Continue working in this manner until the end nearest the folded edge is reached. The buttonhole is rounded at the corners by using the blanket stitch, five of these being sufficient in the end. The regular buttonhole stitch used in the end causes the buttonhole to stand open. Work along the other edge until you are opposite the first stitch. Take three stitches across this end of the buttonhole. They should extend the full width of the buttonhole stitches and be taken in the same place. The bars prevent tearing. To give a tailored appearance, these stitches are covered with blanket stitches. A buttonhole may be made

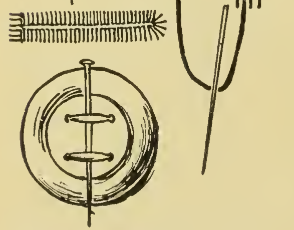


Fig. 31.—Make good buttonholes.

with a fan at one end and bar at the other or both ends fanned or barred.

How to sew on buttons.—The buttonholes are necessarily made first. (Fig. 31.) To make the place for the buttons, be careful that the hems are held evenly; pin them together. Mark the outer edge of each buttonhole with a thread making one stitch. Do not cut the thread in passing from one buttonhole to the next. When all are made, clip the thread between the buttonholes. Separate the lap leaving the thread to make the place for buttons. Take two or three back stitches on the right side of the garment to fasten the thread. Avoid making a knot as the needle is apt to strike against it and break. Put the needle from hole 1 to hole 2. Place a pin under this thread across the top of the button. Continue sewing through holes 3 and 4. Take out the pin and draw the button up from the garment to loosen the threads. Bring the needle up between the button and cloth very close to the stitches, and wind the thread around the stitches from three to four times to form a shank or stem. Take the thread through to the wrong side and fasten it securely. The thread on the wrong side should lie in two parallel rows.

Set of Silver Cases.—This set consists of a knife, fork, and spoon case. Use dark red canton flannel, bind the edges with bias tape or ribbon to match, and featherstitch the division lines. Use silver to measure the size of holders.

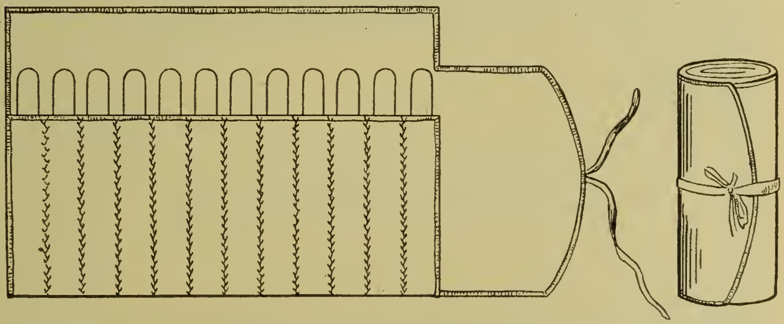


Fig. 32.—A gift for the housewife.

Fig. 32 illustrates a knife case. It is necessary to change only the measurements to adapt it to forks and spoons.

Bedspread and Pillow Covers.—To make the bedspread illustrated in Fig. 33, measure bed and get enough unbleached or bleached sheeting to cover it, allowing it to hang over the edges to within three inches of the floor. Buy enough unbleached pillow tubing for two pillow cases. Two yards of 42 inch or 45 inch will be sufficient.

Use chambray gingham for bands and several color combinations. Green and blue, green and pink, old gold and blue, yellow and blue and lavender and green are good, depending on the walls and coloring in the bedroom in which they are to be used.

Cut the chambray 6 inches wide lengthwise of the material for the stripes on the spread and 4 inches wide for the pillow cases. Sew the strips together until sufficient length has been obtained to go around the entire edge of the spread. Find the center of the side edges and baste a strip of contrasting gingham about 4½ inches wide and 1 yard long, close to the edge. Cut the material from which the band is to be made into some plain geometrical design, so that the cut place will be over the basted band of contrasting material. Turn under the cut edges, baste down and use the blanket stitch to finish. Turn outside edge of the band and spread together and after basting, finish with blanket stitch. The upper edge of the band is turned under and finished last. Use strand floss, threading three strands in the needle at once for this stitch. Usually black gives the best effect. The pillow band is narrower and

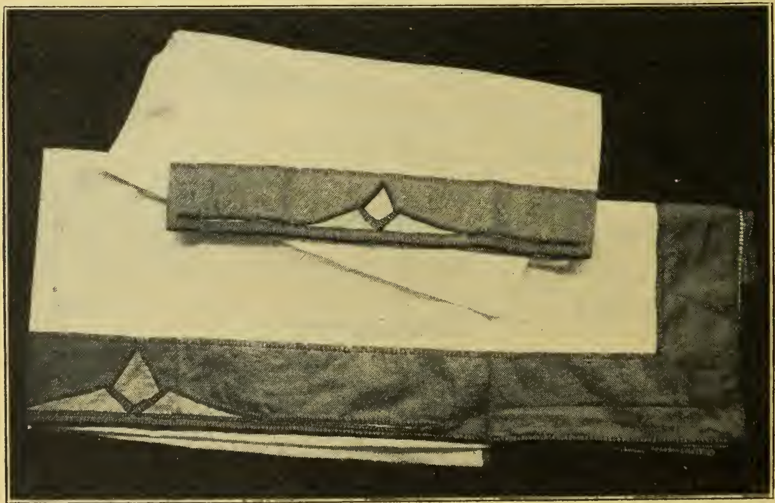


Fig. 33.—Bedspread and pillow covers.

the figure should be smaller in proportion. The corners of the band are joined with a diagonal joining called a miter. When this has been folded cut extra material out from the wrong side of the band to avoid a thick seam. Hem this joining with fine hemming stitches.

To complete the furnishings of the room, window curtains may be made of the same material as the bedspread in a narrower width. Have the bands run down one or both sides of the curtain just inside a two-inch hem. If the windows are short, do not run a band across the bottom. Curtains when finished should be just long enough to reach the edge of the casing.

Light weight pique, Indian head or other similar materials having some body may be used instead of muslin.

Child's Bib Apron.—Use gingham, muslin, linen or any similar easily laundered fabric.

Take the material double the length of the child from shoulder to knee, and from 18 inches to 24 inches wide, depending on age and size of child. Fold material crosswise, then lengthwise and cut as follows:

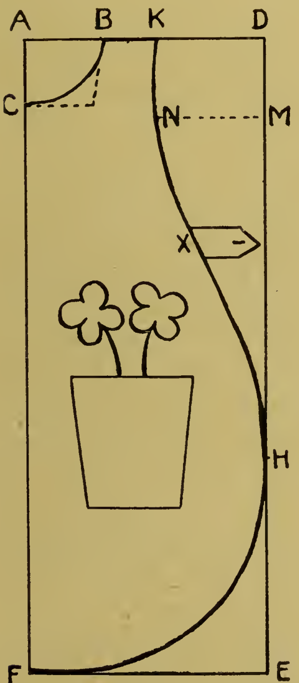
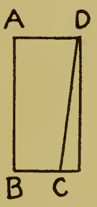


Fig. 34.—Child's bib apron.



Pocket.

AB = 3 inches
AC = 2½ inches
CB = neck curve
DM = 4 inches
MN = 4 inches
BK = 2 inches
DH = Two-thirds DE

Draw curve KNHF

Pocket

AD = 2½ inches
AB = 5 inches
BC = 1¾ inches

For pocket, cut line DC—make one-half inch hem at top—stitch two pockets on apron, and applique flowers.

The pocket may also be made in the form of a flower or animal.

Finish around neck and outside with bias binding. This may be of contrasting color and turned on to the right side and stitched down.

Fasten little tab on either side at X, about 8 inches down from shoulder; work a buttonhole and sew a button to match on the back portion.

This apron may also have large pockets (Fig. 35) in which the child may drop his playthings.

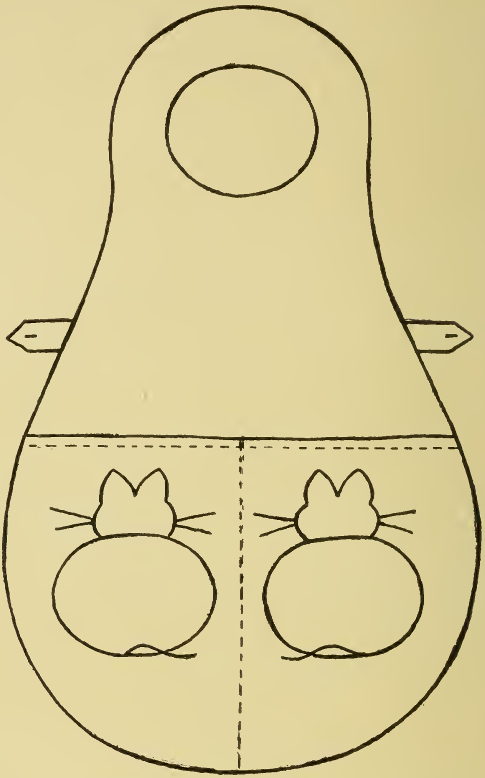


Fig. 35.—Apron with large pockets.

Tam O'Shanter No. 1.—The Tam O'Shanter is the most universally becoming and appropriate style of head gear that the school girl may have. If purchased at the store the price may prohibit many girls from owning one, but when made at home making use of materials on hand, and time which might otherwise be idled away, the actual cost is reduced to a minimum.

There are two styles of tams—one a circular one-piece top, the other sectional. The latter pattern may be used when the material is in small pieces.

The material may be flannel, serge, broadcloth, velvet, velour, plush, or any woolen material which has been used for clothing for any member of the family.

For the plain round tam, take a piece of paper 14 inches square and fold as illustrated.

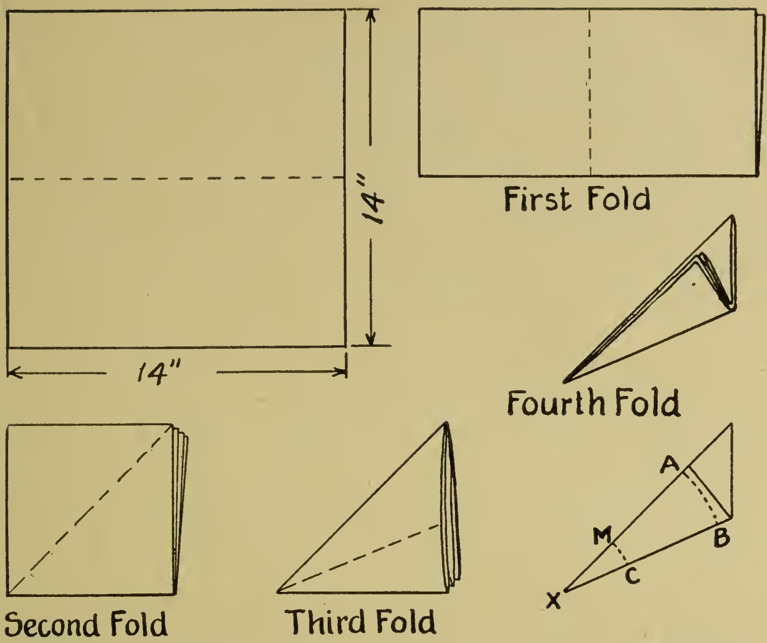


Fig. 36.—Square for Tam O'Shanter No. 1.

When the paper has been folded, with the scissors cut on dotted line AB. This is a very slightly curving line, and will form the outside edge of the tam.

For the headsize.—Take a hat which fits the head comfortably and measure its two headsize diameters. Measure up from point X (Fig. 36) half the length of the shortest measure (XC). Cut on dotted line CM, slightly curved. This makes a headsize. Open pattern, and mark any two opposite creases (Fig. 37). Refold in quarters.

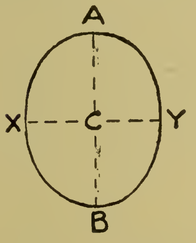


Fig. 37.—Two diameters of headsize.

Take half the difference in length of the long and short diameters and mark this distance XY. Cut on dotted line. This will elongate the headsize and make the tam fit the head better.

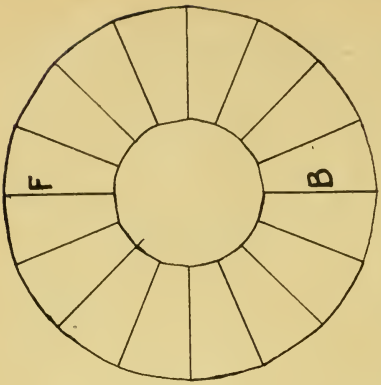


Fig. 38.—Diagram for tam.

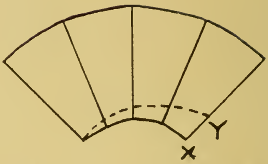


Fig. 39.—Section of tam.

Using the pattern you have just finished, cut a 14 inch circular piece of cloth, and another one with headsize cut out, as in the pattern.

Cut a band the length of the circumference of the headsize plus one-half inch for seam, and 2½ inches wide. This may be pieced if there is not a strip long enough. For an inside lining for the head band, use a piece of buckram 1 inch wide and about two-thirds as long as the head size circumference. If no buckram is at hand, take a piece of heavy muslin and starch it stiffly. It will serve quite as well.

If the Tam O'Shanter is lined, it will be more satisfactory. Use sateen, old silk or satin, or any soft dark material.

Cut the lining the same size as the pieces of the tam and baste carefully to the outside of material. Then with the two right sides of the cloth together, baste around the outside one-fourth inch from the edge, stitch on the machine and turn.

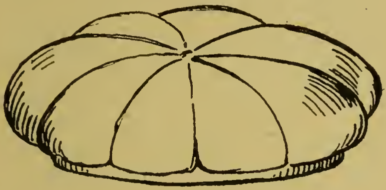
Take a piece of elastic one-fourth the length of the headsize and about three-fourths inch wide and sew securely to either end of the buckram. Sew the piece of material for band with a plain seam and press open. Fold the band material lengthwise through the center, and insert the inner band into this folded piece. Baste this in along outside folded edge of band.

Fig. 40.—Tam Finished.

Baste band, then stitch to tam, making one-fourth inch seam, and the first sewing to the wrong side. Turn down the other edge of band one-fourth inch and hem by hand, using a slanting hemming stitch. The elastic will make the tam fit the head more securely and also make it easier to adjust to different heads.

A band of black silk ribbon with a flat bow may be added (Fig. 40), if desired.

Sectional Tam—(Tam O'Shanter No. 2).—Take a piece of paper 10½ inches long and 6 inches wide, fold lengthwise, and make pattern (Fig. 41).



AB = 10½ inches
AD = 3 inches
DE = 1¼ inches
HB = 3 inches
CX = 3 inches
BB′ = ¼ inch

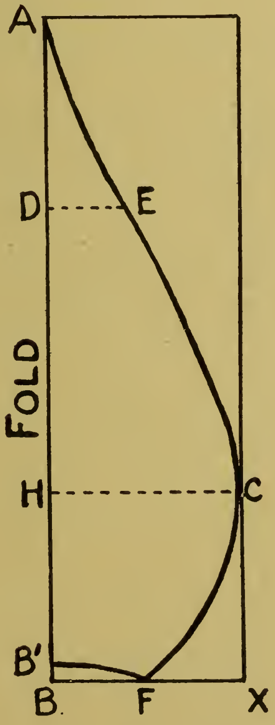


Fig. 41.—Sectional Tam.

Draw curves as shown and cut on these curves.

To Cut: Unfold pattern and cut eight pieces like pattern. If the material does not have a nap or stripe which must be made to run all in one direction, the pieces may be cut regardless of thread of material.

Baste each four pieces, then stitch.

Use one-quarter inch seams and be careful to make the seams come neatly at the center. Then baste the two halves together and stitch.

Make the lining separate, joining the seams just as the cap seams were joined. Insert lining with the seams turned toward the inside of the cap, baste along headsize line, and apply a band using directions given for Tam O'Shanter No. 1.

GARMENTS

The very best work possible should be put into the making of the seams so that the fit of the garment may be more nearly perfect. All washable material should be shrunk and pressed before the patterns are put on the cloth.

Patterns.—Generally speaking, the best plan is to use commercial patterns. These are carefully worked out by experts and, when intelligently used, produce excellent results. If directions are carefully read and followed there will be little difficulty. Do not tamper with neck and arm curves in patterns, and never change the top curve of a sleeve. If a pattern is too small, cut it through the center, separate the pieces until the desired width is obtained. If it is too large, lay a pleat through the middle and take up the extra size. By carefully using the tape measure, the correct size in a pattern may be obtained.

Buy a waist pattern by bust measure, and a skirt pattern by hip measure.

Drafting is an intricate technical process which requires experience and skill both in taking accurate measurements, which are the first requisites of a good draft, and also in the proper drawing of the draft after the measurements are taken.

How to Take Measurements.—Be sure that all measurements are loose enough. It is much easier to make things smaller than to make them larger. While measurements are being taken, stand straight and squarely on both feet with the heels together.

Bust measure.—Pass the tape line loosely over the fullest part of the bust; have it come closely under the arms and slightly raised in the back. It is best to take this measurement from the back in order to take it correctly.

Waist measure.—This is taken snugly directly at the waistline.

Hip measure.—Measure straight down center front 9 inches and place a pin in the dress horizontally at this point. Pass a tape measure around loosely, parallel with the floor. Pin the tape and sit down to be sure sufficient room has been allowed.

For dress length, measure in the back from neck line to bottom of skirt. For skirt length, measure from top of belt in center front to bottom of skirt.

General Directions for Cutting.—After reading the directions, pin all pieces of pattern to the cloth before one piece is cut. Lay on the material economically. Place the large part of the pattern at the end of the material so that which is left will be in one piece. Watch for the "right and wrong" of the material; also watch for the "up and down" and in some broken plaid ginghams, notice the material has a right and left. To avoid cutting two pieces for the same side, place the two right or the two wrong sides of the material together before cutting. Place the dots or markings indicating the straight line of the pattern on the lengthwise threads of the material. Mark all notches accurately; do not cut out the notches; mark with pins. When cutting always cut the full length of the blade of the shears each time and follow the true lines of the pattern. Accurate cutting is absolutely necessary for good results. Usually it is best to cut off selvage, but in straight skirts, if after the seams are sewed the selvage is clipped through at intervals of two inches, the seams will not draw.

Kimona Nightgown

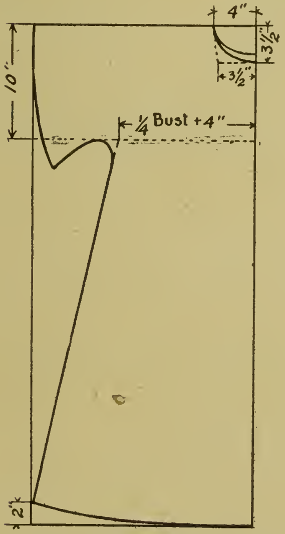


Fig. 42.—Kimona nightgown.

To find the length of the nightgown measure from the base of the neck over the bust to the floor.

For the bust measure, pass the tape over the fullest part of bust, rather high under the arms and raise it slightly in the middle back. This measurement should be taken from the back.

To Make Pattern—Cut strip of paper 3 inches longer than your length measure. As the material used is to be 36 inches wide, cut the paper 18 inches wide. (Fig. 42.)

At the top, or end, of the paper, measure down one side 10 inches for the sleeve. Draw a dotted line straight to centerfront to indicate the sleeve line and bust line. To make the gown loose enough to slip over the head easily, the bust line must be larger than the bust measure. Since the pattern represents one-fourth of the gown, find one-fourth of the bust measure, add 4 inches to this amount, and measure from the centerfront over on the bust line and mark a point; call it A. From this point, draw a line straight to the bottom corner of the paper to represent the side seam line; draw a curve to join sleeve line and side seam line. Drop this line one inch below intersection of bust line with outside selvage. Mark three-fourths inch on this same line and slope to top corner of pattern. This gown would tear very easily if not rounded under the arm. At the bottom of the pattern at the side, measure up about 2 inches and draw the curve for the bottom. At the neck measure 4 inches along the top, 3½ inches down center, and 3½ inches to the left of last dot. Draw dotted lines to connect these points, and change to a curve. Draw another curve 1 inch lower than first one, and in cutting pattern cut upper curve only, making lower one on material with a marker. This drawing may be done on material, thus saving time used in making this pattern. Mark all lines and cut out the pattern. If you do not wish to make a paper pattern, you may make markings very lightly on materials. Remember, however, that lead pencil marks will remain in material permanently if the garment is put into hot water before marks are removed.

Cutting.—Lay the cloth smoothly on a large table, fold it lengthwise through the center and then crosswise through the center. Smooth all wrinkles from the pattern, pin it to the material, with the straight edge along the folded edge of cloth; cut carefully.

Sleeve Finish.—Turn a very narrow hem, not wider than three-eighths inch and baste very carefully. After basting, the hem may be feather-stitched on the right side to hold it, or it may be machine stitched.

Sew a little lace edge to finish using overhand stitch and taking the stitches close together, and just barely catching the material in the sleeve with the needle. The lace should be eased on (not stretched) but never gathered.

Neck Finish.—Always finish the neck of a night dress with a facing. If it is hemmed it is very apt to tear readily.

Use a bias tape, basting it on through the crease in the tape, placing the right side of the tape to the right side of the night dress. Always turn the end of the tape back one-eighth inch on the right side, when beginning to baste and when it has been basted around finish by allowing the end to overlap the turned back end. Stitch, then turn over on to the wrong side, crease, baste carefully and stitch along the edge.

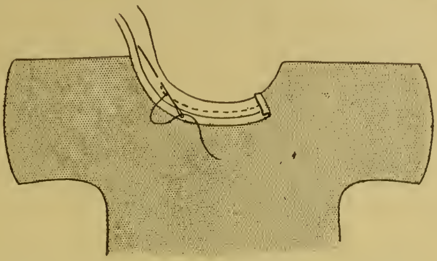


Fig. 43.—Finishing neck with bias facing.

For a square neck use a fitted facing. It is best to cut and apply this facing before sewing the side seams.

Take a piece of material 2 inches longer and 2 inches wider than the length and width of the neck opening. Lay the material on the neck opening and pin carefully. Cut the piece out exactly the shape of the neck. Trim it off 1 inch from edge of neck line. Baste and stitch one-quarter inch from neck line edge. Make tiny diagonal clips from edge of neck opening to stitching line before turning. (See illustration.) Turn facing on to the wrong side of the gown, and baste the edge just stitched. Turn under, baste, then stitch outside edge of facing. This kind of facing insures good square corners.

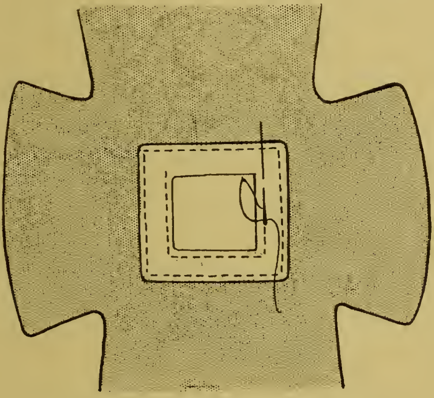


Fig. 44.—Finishing neck with fitted facing.

To Finish With a Scalloped Braid Edge.—Lay the right side of the braid and garment together, with the straight edge of the braid and raw edge of the garment even, and stitch so that the line of stitching is even with the lower points of the scallops. Trim the raw edges of the garment, the braid down on the wrong side, crease, baste, and stitch down flat on the lower edge of the braid. The braid may also be fastened down with feather or chain stitching. Begin and end the scalloped braid at the center front with quarter inch turn-in at each end for the draw string, if one is desired.

BLOOMERS

It is very easy to draft a bloomer pattern. Three measures are required—waist, hip and side length, waist to bend of knee.

Take the waist measure tightly and the hip measure, over the largest part of the hips, rather loosely.

Take a piece of paper 12 inches longer than the side length measure, and 12 inches wider than the hip measure. Newspaper may be used for this, and two pieces may be pasted or pinned together to give the desired length and width.

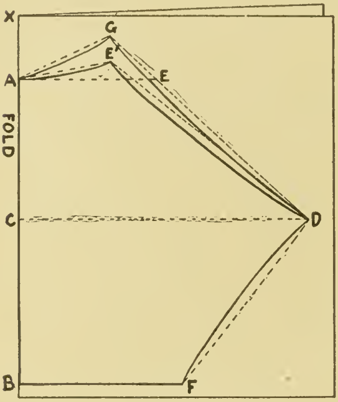


Fig. 45.—Bloomer draft.

Fold paper lengthwise, and follow directions:

Point X to A equals 5 inches.

Point A to B equals side length plus 6 inches.

Point A to C equals one-half A B minus 1 inch.

Point C to D equals one-half hip measure plus 4 inches.

Point A to E equals one-fourth waist measure plus 4 inches.

Point B to F equals one-fourth waist plus 6 inches. (8 inches may be added if more fulness is desired.) Extend E 5 inches to G. Connect A with G. Place E′ 2 inches under G. Draw AE′ and E′D.

To Cut Out Pattern.—With paper folded starting at A, cut to G, D, F, and B. Unfold pattern and cut on curved line from intersection of line A, E′ to D.

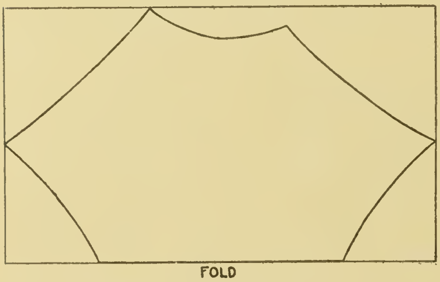


Fig. 46.—Laying bloomer draft on material.

If more fulness is desired at waistline, AE may be made longer.

To Cut Out Bloomers—Fold material crosswise, and lay pattern opened out on with lower edge to cut edge of material (Fig. 46) and cut carefully around edge. It will not be necessary to allow seams on the pattern.

If material is not wide enough, piece on one side only (Fig. 47), join pieces by using a felled seam.

To Make Bloomers.—Pin legs together as in Fig. 48, placing pins at right angles to seams.

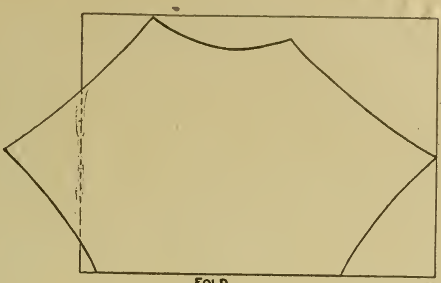


Fig. 47.—Showing method of piecing bloomers.

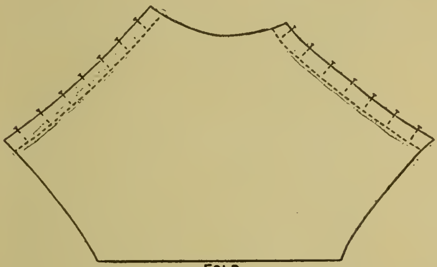


Fig. 48.—Placing of pins.

If seams are carefully pinned, they may be stitched without basting, removing pins as stitching proceeds. Use either felled or French seams for this garment. Felled seams are usually regarded as best.

When these seams are finished, pin and sew leg seams (Fig. 49).

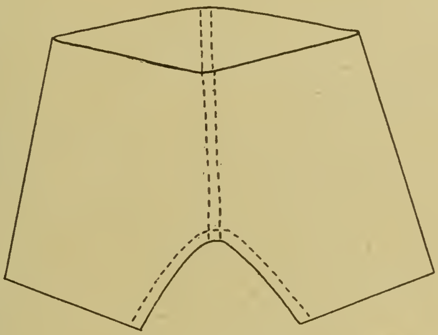


Fig. 49.—Leg seams.

Face the top with a piece of true bias cut one inch wide. When putting this on, turn back the end one-half inch starting at center back baste bias facing, with right side of facing turned to right side of bloomers, and at the end, turn back one-half inch as you did in starting. When this facing is stitched one-quarter inch from the edge, turn over onto the wrong side, crease with thumb nail, baste along top edge, turn under lower edge, baste carefully and stitch. Slip elastic in at opening of bias facing at back, sew elastic together securely after you have made it correct length for waist. Elastic should be four to 6 inches less than waist measure.

Hem lower edge of bloomer legs with three-quarter inch hems. When stitching hems, leave three-quarter inch space unstitched to slip elastic in. In doing this stitch back for 2 inches over first stitching to prevent hem from pulling out. (Fig. 50.) Slip elastic into hem and fasten securely.

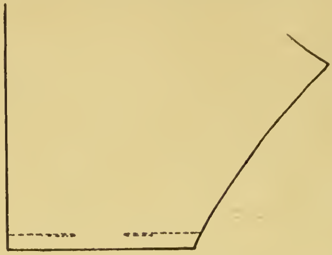


Fig. 50.—Space left in hem for slip-in elastics.

If the waist measure of bloomers before elastic is slipped in is less than hip measure, a placket must be put in, either at one side or back, before top of bloomers is finished. An elastic may then be used at waist line or a band sewed on.

Clothes Hints

Know what you can spend, think over your needs, and keep accounts.

Repair, remodel, care for clothes, and wear out old clothes.

Cut your wardrobe to the minimum.

Select material according to its value and appropriateness.

Choose garments that harmonize.

Be a considerate shopper; carry home packages; pay charge accounts promptly; return goods quickly and in good condition if they are not wanted.

Select clothing that will keep the body clean, dry, evenly and moderately warm, unhampered, and well ventilated.

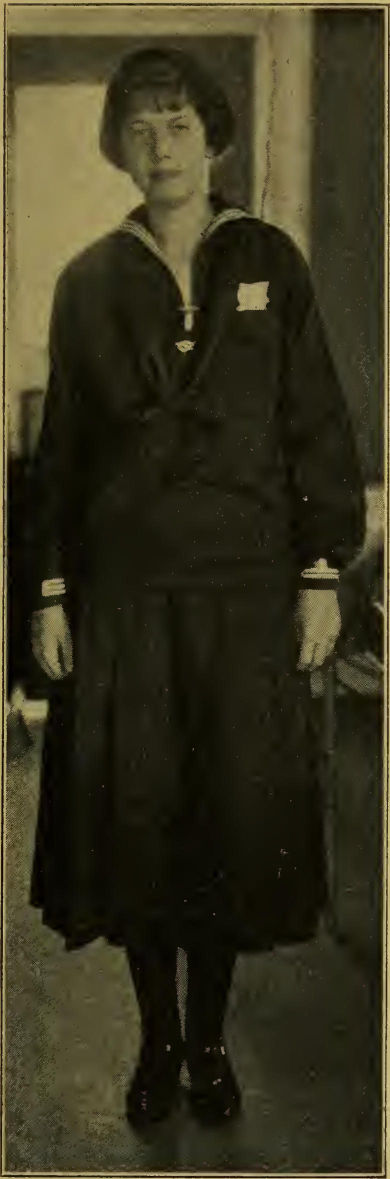


Fig. 51.—Middy suit.

MIDDY AND SKIRT

The following materials are suitable for both the middy blouse and skirt: Indian head, galatea, drilling, kindergarten cloth, poplin, cotton rep, pique, and linen.

Since all of these materials shrink when laundered, it will be necessary to shrink the cloth before cutting out the garment. Materials may be shrunk by dipping them in hot water, pressing with a damp cloth, sponging and pressing. The first method is the most effective.

When the material has been shrunk, hang cloth by the selvage to dry. Be careful in hanging it not to stretch it. Occasionally turn the cloth, pinning by the other selvage. When it is almost dry, iron it on the wrong side. Should it get too dry, the cloth may be dampened with a sponge before pressing.

PLEATED SKIRT FOR MIDDY

To make a pleated skirt with pleats sufficiently wide to stay in press, one must have three times the hip measure in the skirt width. For example, if the hip measure is 40 inches—three times that or 120 inches would be 3⅓ yards. If the material is 1 yard wide, one must have 3⅓ widths.

Sew up seams, using a plain seam, overcasting where there is no selvage, and clipping selvage edges at intervals of about 3 inches. Just a tiny clip through the threads at the selvage edge will prevent drawing. Press seams open flat.

Mark center front and center back with a basting thread. Make placket 10 to 12 inches long in back of skirt.

Shrink belting by pouring hot water on it and when dry be sure it is correct waist measure in length. Hem ends and sew large hooks and eyes on it. Mark center-front of belting with basting thread.

For 2 inch pleats, divide waist measure by 2. For example, if the waist measure is 28, the resulting quotient will be 14, and there will then be 14 two-inch pleats. Should the waist measure be 30, thereby making the number of pleats 15, use 14 pleats, making each one a very small fraction over 2 inches in width.

Subtract waist measure from entire width of skirt. Example, 120 inches minus 28 inches equals 92 inches.

Divide this remainder by number of pleats ($92 \div 14 = 6\frac{4}{7}$) or about 6½ inches. This means that each time a pleat is made 6½ inches must be folded under. (Fig. 52.)

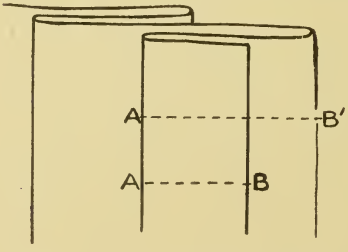


Fig. 52.—How to make pleats.

A to B equals 2 inches.

A′ to B′ equals 3¼ or one-half of 6½.

Pin skirt to belting at center front. Start with backward turning pleat, which will make a box pleat in front, double the width of the other pleats, measuring each pleat carefully and continue to the center back when an inverted pleat will be formed. Do the same with the other side of the skirt, and when the pleats are pinned to the belt, try the skirt on. Have some one spread the pleats over the hips and pin them to place.

If the hips are not full, it may not be necessary to spread the pleats very much. Next be sure the crosswise thread of the material is running straight around the hips, parallel to the floor. If it is not, lift the skirt on the belt and pin it to place. Turn top edge of skirt under and stitch to top edge of belt, or trim off top edge, allowing skirt to lap over on to inside of belt one-half inch. Baste down to inside of belt and stitch on a piece of bias tape to cover raw edge. This may be stitched through the skirt, but should be carefully basted first. Be sure to allow the lap side of the placket to extend out from the end of the belt. The belting must not lap but just meet. Finish the raw edge of lap by binding with a little piece of bias tape.

Hem for Skirt.—Stand on a table or platform and measure with a yard stick, or a gauge cut from heavy cardboard, the desired number of inches from the floor. Mark the line around the skirt with pins. Turn up the edge at the pin marks and measure again to see that the skirt hangs evenly. Finish the hem according to direction given for making the hem of a nightgown. If the material is very heavy, the raw edge of the hem may be bound instead of turned in.

Fasteners.—Hooks and eyes or snaps are used instead of buttons where invisible fastenings are desired. The hooks are sewed far enough back from the edge of the opening to prevent them showing. Fasten the hook with a few stitches to hold it in place, then buttonhole it to the garment with the purl on the outside of the ring or sew securely with over and over stitch. Fasten the hook securely with several stitches at A, the point where it bends. The eye should extend a little beyond the edge so that it fastens easily; and be sewed securely at B. If flats are used instead of eyes, place them far enough from the edge to make them hook properly. Snaps are also buttonholed or sewed to the garment with over and over stitch.

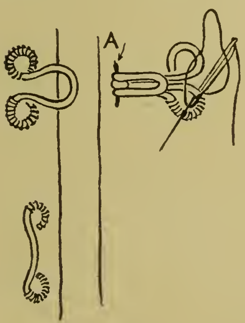


Fig. 53.—Earmarks of a carefully made garment.

If the thread matches the garment the fastening will be less conspicuous. Garments should never be fastened with pins.

THE MIDDY BLOUSE

The middy blouse may be made to slip over the head, and with long or short sleeves. Buy the pattern according to the bust measure.

Cutting and Fitting.—Follow the directions for cutting out the blouse given on the pattern envelope. Baste with the notches, marked by pins, matching them and try the blouse on with the seams on the outside. Stay the neck by basting a straight piece of material 1 inch wide around it to prevent fraying or stretching during fitting. Pin in necessary alterations and re-baste the seams. The shoulder seams are flat-felled and should be turned toward the front. Attach sleeves to the blouse with a flat-fell seam. The sleeve and under-arm seams are sewed up in one operation, using a French or felled seam, the seam one-quarter inch wide. A middy sleeve will set better if the top of the sleeve is an inch longer than the armseye. Hold the sleeve in slightly as you sew it in to take care of this slight difference in length. Always turn the middy on to the sleeve.

Sleeves.—The regulation middy sleeves are long and full at the cuff. The sleeve may be made elbow length, however, and either hemmed, or finished with a turnback cuff 2 inches to 3 inches wide. Join the sleeve and blouse, matching the pin marks, and stitch in the sleeve with a flat-fell seam, the edge of the blouse coming over on the sleeve. Baste the under-arm and sleeve seam and try on the blouse to see if the sleeve fits properly. Then stitch, making a flat-fell or French seam.

Cuffs.—Cuffs should be cut 5½ inches wide since they are double and long enough to button tightly around the wrist—about 7½ inches to 8 inches is average length. Cut cuffs lengthwise of material. When finished the cuff should be about 2¼ inches to 2½ inches wide. Fold each cuff lengthwise through the center and crease. Open it up and lay it flat on the table. On the lower half of the cuff, stitch three rows of narrow linen or silk braid one-quarter inch wide. Set the tape its own width apart as shown in the illustration. The middle row should come in the center of the lower half of the cuff. Baste the tape firmly on the cuff with slanting basting stitches, and try to prevent puckering

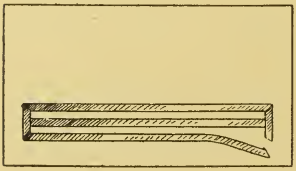


Fig. 54.—Collar and cuffs trimmed with braid.

during the operation. Stitch the tape on both edges. Make a placket in the sleeve seam. Gather sleeve with small stitches, adjust to fit cuff length, baste, then stitch underside of cuff to gathered edge in one-quarter inch seam. Turn top of cuff down one-quarter inch and stitch carefully to sleeve. This stitching may be continued all around the cuff.

Collar.—The collar should be cut with the center back of the pattern on the lengthwise fold of the material. The facing is cut the same way. It may be of contrasting color or of the same material as the blouse. The collar facing is trimmed with three rows of linen or silk braid, just as the cuffs are. The outer row is set one inch from the edge of the collar. After the three rows of braid have been stitched on the facing, press it well. Lay the collar and facing with their right sides together and stitch one-quarter inch from the edge. Cut away the material on the seam at the two corners but not so closely as to cut the sewing thread. Turn the collar so that the right side will be out; pull out the corners well and press the edges so that they will lie perfectly flat. Before basting the collar to the blouse, draw a line three-eighths of an inch from the edge of the collar which is joined to the blouse. This serves as a guide in basting, sewing the collar to the blouse, and turning the edge of the facing under evenly so that it will lie smooth and flat. It should be marked with pins to show where it joins the blouse. When basting it on, the edge of the collar should be stretched slightly between the pins to fit the corresponding edge of the blouse so as to make the collar roll closely at the neck. Baste and stitch in the traced line. When this seam has been stitched, clip or notch the edges of the seam to ease it, but be careful not to cut the stitching. Turn the seam toward the inside. The inner edge of the facing is turned under at the tracing, basted down just even with the collar, and stitched flat to the blouse. The braid may be sewed on after the collar is joined to the middy—in which case it continues down below the front opening of the blouse and finishes on the wrong side.

The patch pocket is stitched to the blouse on the left side with a double row of stitching three-eighths of an inch apart.

The bottom of the blouse may be finished with a wide hem, or a wide facing. Put three or four eyelets at the neck opening for lacing it.

⁂

PETTICOAT

This petticoat is very simple and satisfactory and has a seam on either side.

Materials suitable for petticoat are: Cambric, muslin, longcloth, nainsook, pique, sateen (white or colored), gingham, pongee, taffeta.

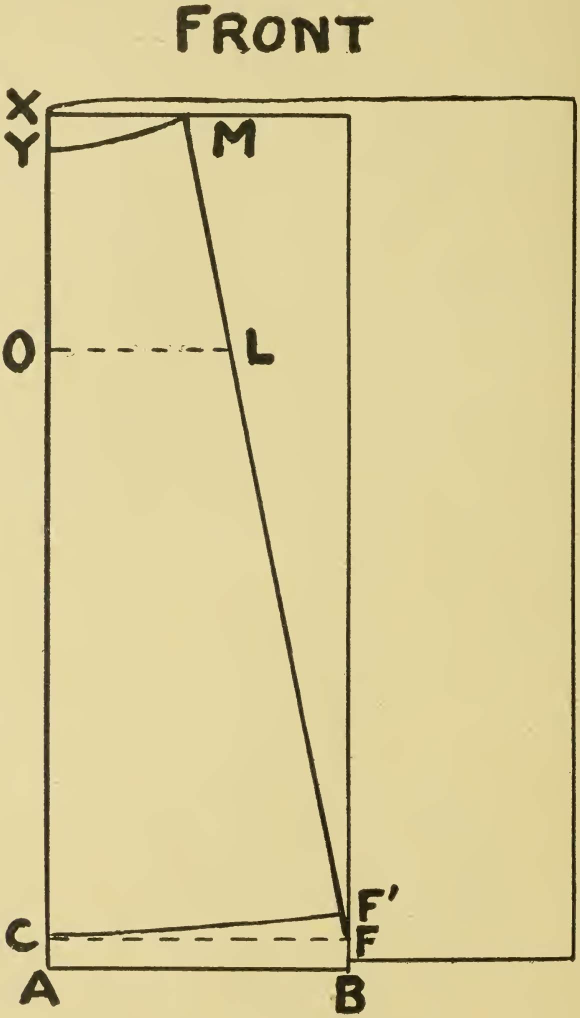


Fig. 55.—Front of petticoat.

Measurement required: Waist, hip (take hip measure 9 inches down on center front and straight around parallel with the floor), front length, back length. Use two lengths of material each the length of the back. Fold material lengthwise, folding over a piece equivalent to one-quarter width desired at bottom less 2 inches.

AB equals one-quarter at bottom minus 2 inches.
XM equals one-quarter waist.
XY equals 1¼ inches.
Draw YM, slightly curved.
YO equals 9 inches.
OL equals one-quarter hip.
YC equals front length.
CF equals one-quarter width at bottom.
Draw MLF.
FF′ equals 1 inch.
Draw CF′, slightly curved.

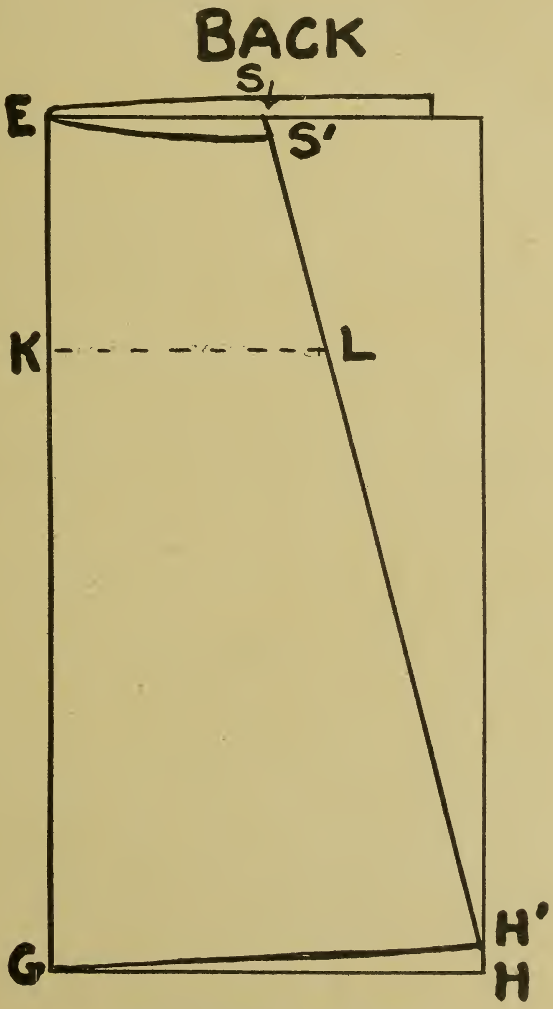


Fig. 56.—Back of petticoat.

EG equals back length. (Fig. 56.)
GH equals one-quarter width at bottom plus 4 inches.
EK equals 9 inches.
KL equals one-quarter hip plus 4 inches.
ES equals one-quarter waist plus 4 inches.
SS′ equals three-quarters inch.
Draw S′E.
Draw S′LH.
HH′ equals 1 inch.
Draw GH′, slightly curved.

To Cut.—For front, cut on lines YMF′C and for the back on lines ES′H′G. Cut an opening down center back 12 inches long and make a continuous faced and bound placket.

Pin together or baste side seams and stitch on machine. Start to sew at top of petticoat and let any unevenness come at the bottom. The seams may be either French or felled. The top may be finished by facing with a bias piece, as in the bloomers, and an elastic inserted. This method is recommended only when the petticoat is of dark sateen or other material which will not require boiling during the laundering process.

For a petticoat which will be frequently laundered, the best finish at the top is a narrow band—made lengthwise of the material. One inch wide finished is wide enough. Tear the strip the waist measure plus 1½ inches for laps and turn in on each end, and 2½ inches wide.

Gather back of petticoat with very small stitches beginning 1 inch from side seams.

Draw gathering thread to fit the belt. Baste belt with seam to right side and stitch.

Turn in ends of belt, turn down lengthwise edge one-fourth inch, baste down carefully to last stitching line, then stitch on the machine.

Work a buttonhole in the band and sew on a button.

The front panel of this petticoat may be made double, so it may be worn under a very thin dress, the double panel saving the necessity of another petticoat. The two pieces which are cut from the front panel and then stitched up in the side seams. (See hem for middy skirt.)

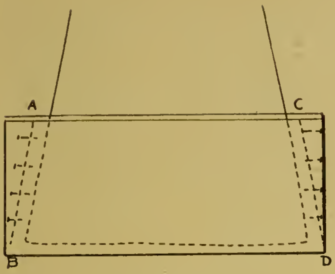


Fig. 57.—Finish for bottom of petticoat.

This skirt may be finished with large scallops; if this is done, a half yard more material will be required.

Tear the half-yard in half crosswise, and fit the two pieces double around the bottom of the petticoat.

The seams in the facing need not necessarily come in the same place as the petticoat seams.

Trim off after pinning, on lines AB and CD. Take a piece of paper 6 inches wide and as long as half the width of the petticoat. Fold it crosswise four times, thus making sixteen divisions. Take the scissors and slightly round the end to form half a scallop (Fig. 58), being sure to start the lower edge of the scallop from the side where the open edges are, marked X in illustration.

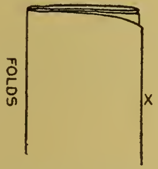


Fig. 58.—Folding for scallop.

Apply this pattern to bottom of petticoat before the fitted facing has been removed, pin and cut very carefully.

Remove the facing, sew the seams, using plain seams—place it back on the petticoat with right side of facing to right side of petticoat, match the scallops, pin and baste, stitch around scallops three-eighths inch from the edge and with the scissors clip in between scallops (Fig. 59), being careful not to clip threads. Turn facing back on to the wrong side of the petticoat, baste carefully the lower edge of scallops—turn in and baste top of facing and stitch carefully. The lower edge may be stitched although it is not necessary. Blanket stitch done with a heavy mercerized floss sometimes adds to the effectiveness of a petticoat with a scalloped edge.

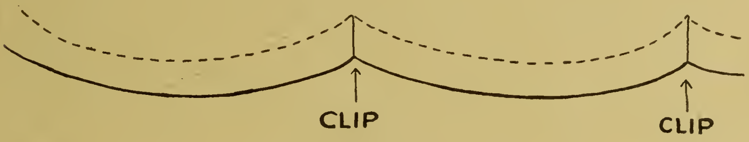


Fig. 59.—Making scallop.

Placket.—Cut a strip of cloth lengthwise of the material 2 inches wide and twice as long as the placket opening. Place the right side of this strip against the right side of the skirt and baste it around the placket beginning at the top of the right side. Narrow the seams as much as possible at the apex of the placket so it will lap without a pleat when finished. When stitching this on the skirt have the placket strip underneath.

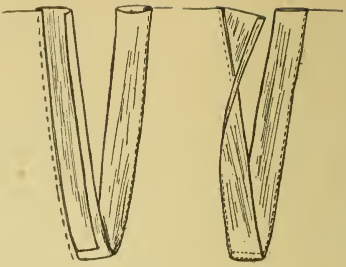


Fig. 60.—Placket.

Make a crease one-quarter of an inch wide on the other side of the placket piece, turn it to the wrong side of the garment and place it so that the edge just covers the first stitching. Continue the fold that was made on the under part down the center, and place it against the wrong side of the upper piece of the garment. Cut away the material that is not needed, leaving enough for one-quarter inch seam on the side, and one-eighth of an inch apart at the apex of the placket for strengthening purposes.

ENVELOPE CHEMISE

This garment may be made from one yard of 36 inch material.

Cut 10 inches crosswise from the material and sew it to the selvage edges of the remaining piece using a French or flat-fell seam. (Fig. 61.) Fold with center line through center of long piece. Shape lower edge as in Figure 62. The lower edge X may be sewed to Y in a French seam, and the sides left open half-way up. Edge X may be hemmed or three buttonholes worked in. Stitch a piece 3 inches long 1 inch above edge Y on under side of garment, and button the flap.

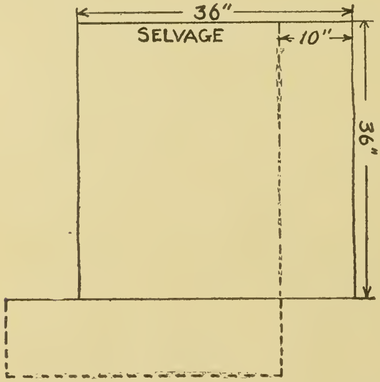


Fig. 61.—First step in envelope chemise.

The top is to be finished in camisole style. Turn down a three-quarter inch hem. This may be machine hemstitched or hemmed by hand. Shoulder straps in either case may be of ribbon, lace, insertion or straps made of the material. In order to place the straps correctly it is best to put the garment on and pin them to position. Work an eyelet on the underside of the hem around the top, and draw through a ribbon or piece of lingerie tape to adjust the fullness. This will be found a very satisfactory garment.

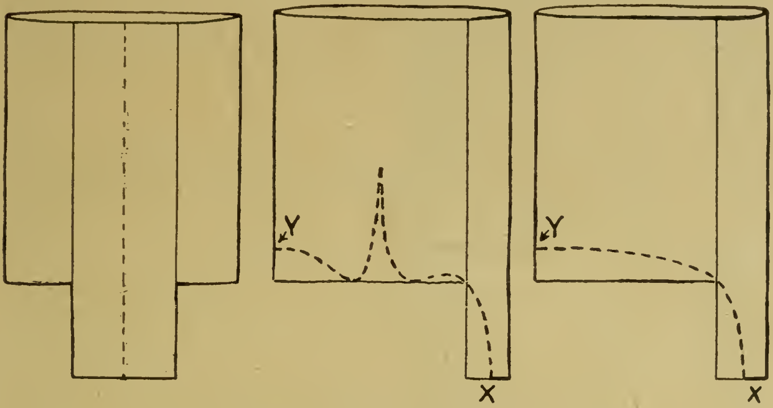


Fig. 62.—Back and two styles for lower edge.

If the person for whom this garment is intended is quite tall but thin it will be best to have from 1⅓ to 1¼ yards of 36-inch material. If tall and stout, the person should get material 40 to 45 inches in width and from 1¼ to 1⅓ yards in length and the crosswise strips 15 inches instead of 10 inches in width.

This is a splendid design for silk or nansook or any soft material.

A DRESS THAT IS EASY TO MAKE

This is a type of dress that any girl with very little experience in sewing can make successfully. Gingham, linen, percale, or any other easily laundered material may be used.

It is best to use a commercial pattern for a dress, and follow directions. Always check up measurements before cutting into material. It is much easier to make alterations in the pattern than it is in the material. Be sure the chest measure is wide enough, as well as the measure across the back between the shoulders. If the arm's eye is too small, trim it out under the arm. (Fig. 64.) Always be sure in fitting-in the sleeve that the top or highest part of the sleeve is placed at the highest part of the shoulder which is usually at the shoulder seam. The straight thread of your material in the sleeve should run from the top of the shoulder, straight to the elbow. Any slight fullness in the sleeve should be scattered over a distance of about three inches, beginning at the shoulder seam and extending to the front. Back of the

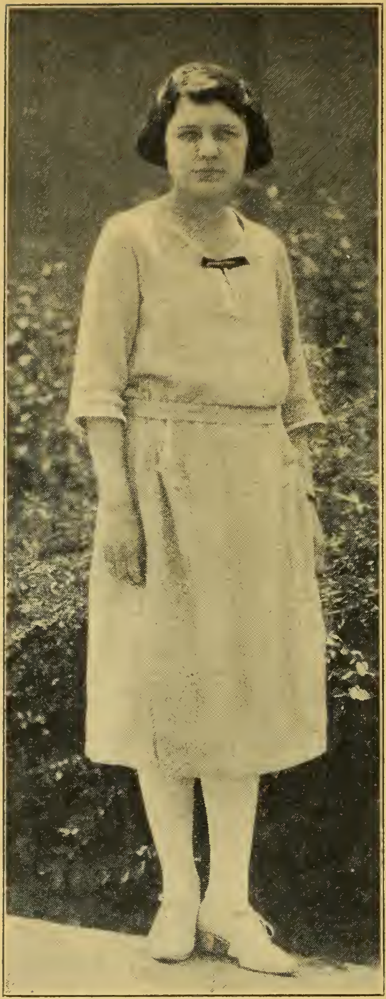


Fig. 63.—A simple, easily made dress.

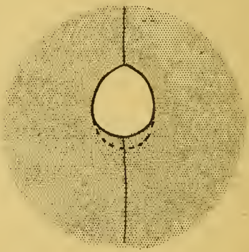


Fig. 64.—Arm's eye.

shoulder seam the sleeve should fit easy without any fullness.

To put on a bias binding for trimming, cut the binding four times as wide as you wish the binding to be finished. Fold the bias through the center and press it but do not pull on it or stretch it. Sew the cut edges to the right side of the edge you wish to bind, then press the binding so the cut edges are turned toward the folded edge. Then turn the folded edge over to line of first stitching, baste and stitch carefully.

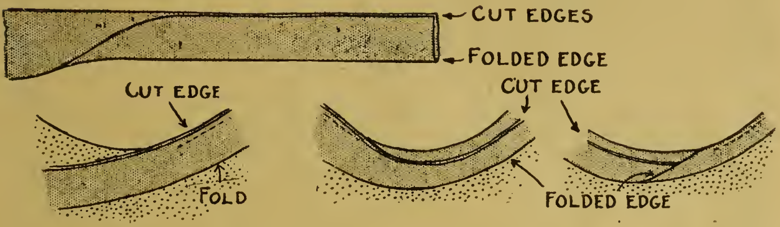


Fig. 65.—Bias binding for trimming.

The small decorations may be cross stitch or any dainty bits of embroidery. Use two contrasting colors or two shades of the same color.

If the cuffs are made for short sleeves they should be about 13½ inches long and 3½ inches wide finished, and if for long ones 8 inches long and 3½ inches wide finished.

Hot Roll Cover.—Cut an 18-inch square of white linen or Indian head. Cut 6-inch squares out of each corner. Blanket stitch or crochet the edge in white or color. Cut out and applique flower design in colored chambray on one corner. A cross stitch or other simple embroidery design may be used instead of the applique. This may also be used as a case in which to keep napkins.

Luncheon Cloth.—The one in Fig. 66 is white linen, machine hemstitched in blue. The threads may be drawn and the hemstitching done by hand if preferred.

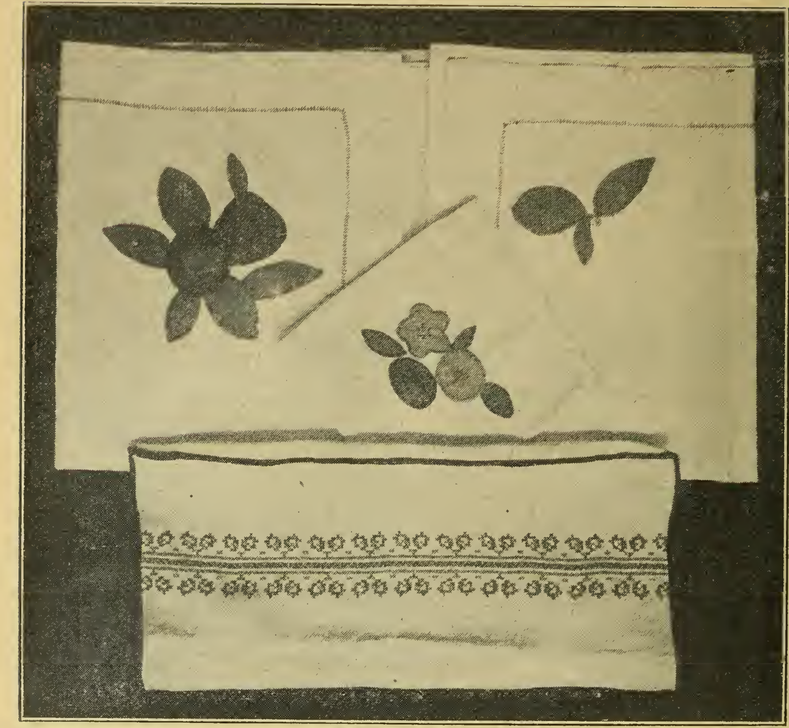


Fig. 66.—Upper, Tray cloth; center, Hot roll cover, with applique; lower, Luncheon cloth with applique.

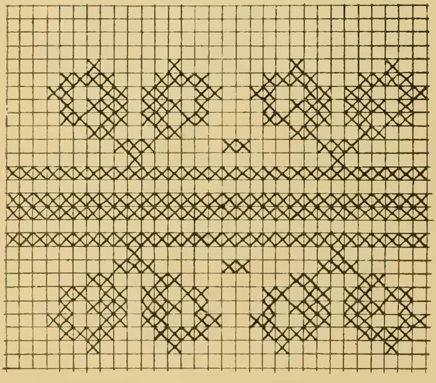


Fig. 67.—Cross stitch for tray cloth.

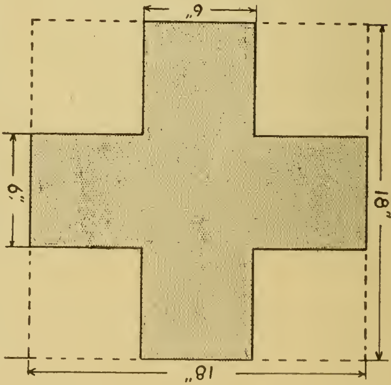


Fig. 68.—Hot roll cover pattern.

The applique design represents fruits and flowers—pears, plums, apples, and peaches. Each corner had a different design. The luncheon cloth may be made any size, a 45-inch square is a good size if linen that wide can be obtained. Otherwise 36-inch linen will do, making a cloth one yard square.

Make luncheon napkins, 15 inches to 18 inches square, hemmed by hand with a narrow hem. Use a cross stitch in two colors or two shades of one color for a decoration.

Collar and Vest of Pongee.—Collar: 26 inches long, 5 inches wide finished. Make one-half inch hems. Vest: 15 inches long, 8 inches wide finished. One-half inch hems top and lower edge, one-eighth inch hems along the side.

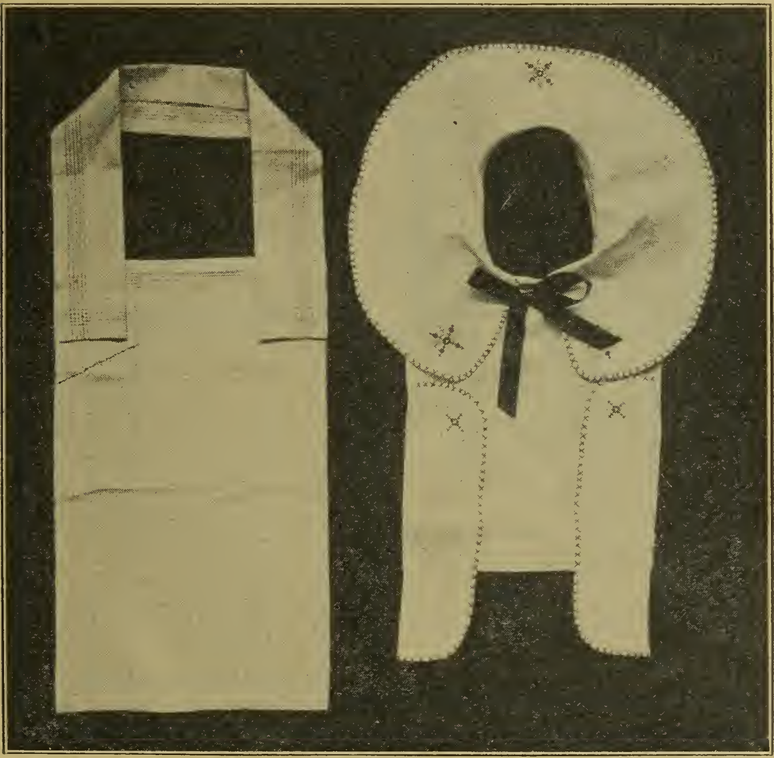


Fig. 69.—Collar and cuff sets.

Collar Attached to Vest.—Use pongee, linen, gingham or lawn. Turn very narrow hems and cross stitch over them to hold them in place. Use strand floss for this.

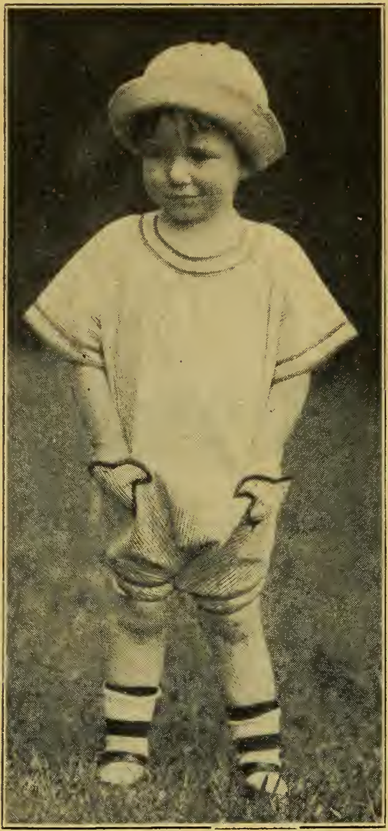


Fig. 70.—One piece romper finished.

ONE PIECE ROMPER

(For 2-year-old child)

Use percale, gingham, kindergarten cloth, linen, or any other material which could be easily laundered.

Make a paper pattern following directions given here.

AB = 48 in.
AC = 12 in.
CD = 4 in.
CX = 1½ in.
XY = 2½ in.
Draw neck curve CYD
XM = 12 in.
EM = 7¾ in.
MF = 7¾ in.
AG = 8½ in.
EH = 2½ in.
Draw curve EHG

FJ = 2½ in.
DK = 15¾ in.
KO = 9½ in.
Draw curve FJO
KP = 7½ in.
R = One-half of KP
RT = 5¾ in.
PS = 9½ in.
BV = 8 in.
Draw OTS
" SV
" BV

AG and EMF are slightly curved lines.

This pattern may be made smaller or larger by varying line DR.

To Cut.—Lay pattern with edge AB on fold and pin carefully, then cut. Cut through fold AC for opening down the back.

To Make.—Finish neck with fitted or bias facing. (See directions for finishing night dress neck.) Finish closing down the back on the left side with an extended facing 1 inch wide finished, upon which the buttons will be sewed, and on the right side a plain facing in which to work the buttonholes. Make narrow hems across lower edge of back piece.

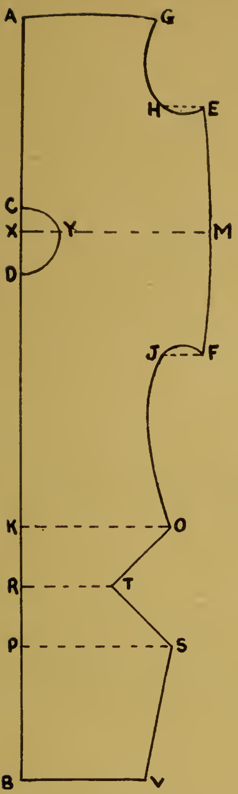


Fig. 71.—One piece romper, first step.

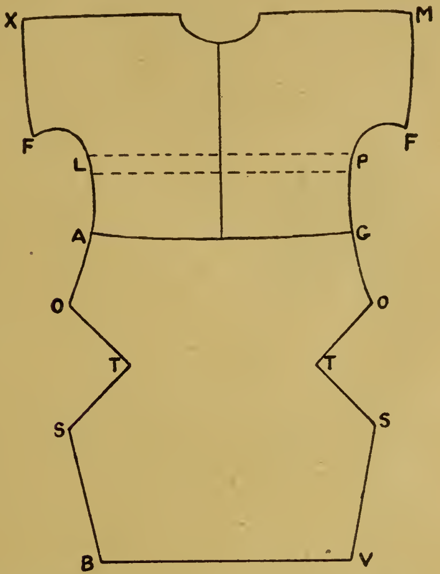


Fig. 72.—One piece romper, second step.

Fold back of romper over onto front as in Fig. 72. Make French seams at lines FA and FG. Make narrow hems at lower edge of sleeve XF-MF. Face leg openings OTS with fitted facings. Face BW (Fig. 80) with 1 inch strip of material. Make French seam at OW 5½ inches long. Sew a band made from lengthwise strips of material to be 1½ inches wide finished (3½ inches whole width of band before applying) to edge BV of rompers. Apply band LP (Fig. 72 to match band on

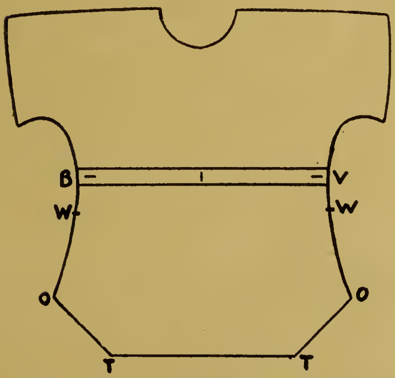


Fig. 73.—One piece romper, third step.

BV. Work three buttonholes on band BV as shown in illustration.

Apply appliqued pockets, trim in bands of contrasting material or with featherstitch or other decorative stitch.

PONGEE HANDKERCHIEFS

To draw in threads—use strand floss—take one strand more than double the length of the handkerchief. Decide where the stripe is to be, draw one thread, leave one thread, and draw the third one. Tie the thread left with a single knot to the doubled end of floss, as in Fig 75. Pull the linen thread at the end opposite to the end where it is tied. Do this quite carefully, and if the thread breaks tie the floss to the fourth thread in the linen. If the linen is rather coarse, draw one thread and tie the second thread to the floss. Do the same with pongee.

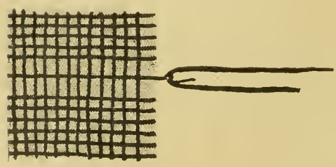


Fig. 74—Drawing threads in handkerchiefs.

The hem on the edge may be hemstitched, or a colored thread drawn in twice as far from the edge as you wish the width of the hem to be, and the hem then turned back and hemmed down with very fine thread.

To make little flowers on a handkerchief use blanket stitch, starting at the center of the flower and bringing the purl to the outside edge of the flower. For leaves use lazy-daisy stitch, which is made like the chain stitch. Initials are done with French outline stitch which is made by folding material on the line of the initial and making the stitch over and over the fold.

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Convenient Kitchens

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AN EFFICIENT KITCHEN is one so arranged that all work is reduced to the fewest possible movements. Such a kitchen saves the worker's time; makes the work easier; eliminates waste; and lowers the cost of light, heat, and cleaning.

The kitchen must be the most sanitary room in the house. It needs the sun at all hours of the day. There should be windows on two sides of the kitchen and a service porch connected with it and the back hall.

The size of the kitchen depends on the number of workers and the uses to which this room must be put. A small kitchen with an alcove dining space for either family or field workers saves many steps. A small kitchen with every inch of wall space used for storage or for working surfaces means greater efficiency for the housewife.

Convenient Kitchens

MAY L. COWLES

CONVENIENT, attractive kitchens are more than an aid to housewives—they help to create happy, healthful home life.

The average kitchen, whether in town or country, makes work instead of saving work. Often it is gloomy and ill-ventilated and frequently so poorly arranged and equipped that the mother spends twice the amount of time and energy in preparing meals that she would need to do in a well-planned kitchen. This waste of time and strength means that the mother is often over-tired and that the children are deprived of attention they might otherwise have had.

Whether you are building a new house or remodeling the old one, plan your kitchen carefully, for it is one of the most important rooms in the house. A successful plan is always based on a careful study of the actual steps the housewife follows in doing her work and is arranged to prevent needless crossing and recrossing of these main routes.

Location of Kitchen

A large part of the work of the home is done in the kitchen. The other parts of the house which have to do with carrying on this work must be carefully arranged in relation to the kitchen.

Dining Room. The distance between the preparation area in the kitchen and the place where the food is served should be as short as possible. A long or winding route increases by miles the walking which the housewife must do in a day. In the smaller house the dining room is being replaced or supplemented by the dining alcove with built-in table and benches.

Basement, Basement Stairs and Dumb Waiter. If food is stored in the basement, the housewife must make several trips there during the day. It should not be necessary to walk a great distance to reach the basement stairs. They may go down direct from the kitchen or from an entry close to the kitchen door. In the basement the bins or shelves containing stored food should be readily reached. A dumb waiter by which food may be lowered or raised to the kitchen saves many trips to the basement.

Back Entrance. The back door should be near both kitchen entrance and basement stairs and so placed that the kitchen is not made a passageway in going from outside to the basement. In Wisconsin, where the problem of heating is important during most of the year, it is wise to have the back door open into an entry way or vestibule rather than directly into the kitchen.

Front Door. Since the housewife must frequently answer the doorbell, the front door should be located so that she walks as short a distance as possible. The passageway should be direct and not pass through other rooms. In some of the recently built houses this problem has been solved by putting the kitchen in the front of the house.

Laundry. If the laundry is on the first floor it must be near the kitchen both for convenience and to save on construction by centralizing the plumbing.

Planning the Kitchen

The modern kitchen is now used mainly for meal preparation. Since most housekeepers do their work in a definite order the kitchen plan must take into account the steps taken in preparing meals and allow work to be done in its natural order without crossing of paths.

These steps are: Preparing food, cooking food, serving food, and washing and putting away the dishes and utensils.

Preparing Food. (a) The perishable food is brought from the ice box or dumb waiter, stored food from the basement, or staple dry supplies from the storage cupboard. The necessary utensils are taken from utensil cupboards or from hooks or shelves above the work table.

(b) The food is then prepared for cooking by washing at the sink or mixing at the work table.

Cooking Food. This is done largely at the range. If gas is not used a place for the kerosene stove must be planned for summer use. If the kitchen is small, a cupboard on the floor level under the work table into which the fireless cooker may be pushed is a great convenience.

Serving Food. This takes place from the range if the food is hot or from the work table or ice box if the food is cold. Serving table, shelves and tea wagon are used to lessen the trips from range to dining room.

Clearing Away. From the dining room the soiled dishes come back to the sink. A work space of some sort should be near the sink where the dishes may be scraped, sorted and stacked. The drainboard on which the washed dishes are placed should be on the left because the average person reaches for a dish with the left hand, holds it with this hand and washes it with the right. If the drainboard is not on the left, each dish must be changed from one hand to the other as it is washed. A movable table or wheeled tray may be placed near the sink for the soiled dishes.

After the wiping process, the clean dishes and utensils are put away in their places.

Grouping of Equipment

To do this sequence of work with the greatest ease and speed, the equipment must be grouped compactly.

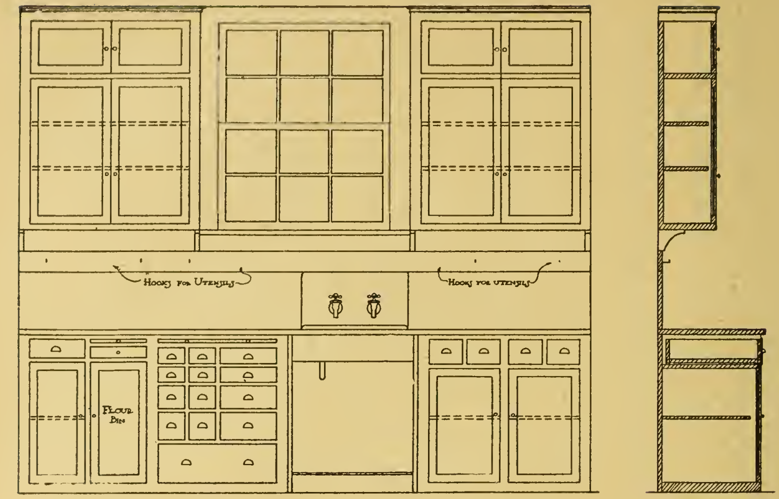
1. Work table, utensil cupboard, and supply cupboard, must be very close together, with the ice box or dumb waiter located near by. The sink must be conveniently near this group and also near the dining room so as to make the dishwashing easy.

The ice box must not be too near the stove. Placing the ice box in a separate room, such as a pantry or entryway, saves ice, but it is doubtful whether the saving is worth the extra walking.

2. The range, dish cupboard and serving area are very closely related. They must be near the meal preparation group and also near the dining room door so that the food may be served easily. The serving area is frequently of greatest convenience if it takes the form of a movable table which may be placed where wanted.

Because so much must be put into a small space in a compact grouping, the separate work table is not advisable. The space below is usually wasted; and food and utensils of all sorts must be brought to the table when they are wanted, instead of being at hand.

A very satisfactory type of compact equipment is shown in Figures 1 and 2, and has been used in most of the kitchens illustrated in this bulletin. The work table, at least 34 inches from the floor, extends across one end of the kitchen. Space below is built in solidly with cupboards except beneath the sink where it must be



ELEVATION showing WORK TABLE SINK AND CUPBOARDS

CROSS SECTION

FIG. 1.—ELEVATION OF KITCHEN A

This compact kitchen work area combines work table, cupboards and sink in a convenient, easily used group.

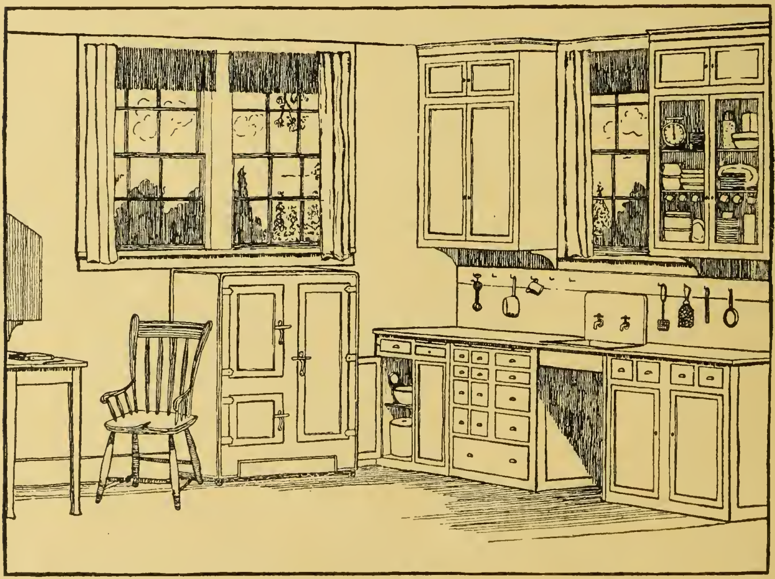


FIG. 2.—KITCHEN A IS WELL LIGHTED AND HAS A REST CORNER

A small set of book shelves, a tiny table and a comfortable chair make it possible for the worker to rest or make up her grocery list during intervals of working.

open to allow easy access to plumbing. Utilization of this area below the work counter is very desirable, as it is otherwise unused space, difficult to clean.

Above the work area, space is clear for 18 inches to keep the work table free for use. Cupboards fill in the space above this to the ceiling. A cupboard top left a number of inches from the top of the room is simply a dust catcher and wastes valuable space. Hooks are placed below to supply a convenient place to hang utensils most frequently used. The upper portion of the cupboard is in a separate division reached by smaller doors. These upper cupboards may be kept for less used utensils and supplies and need not be opened every time the lower part is used. Such equipment as this gives in one concentrated group the work table, sink and cupboards for utensils, staple supplies and dishes. The arrangement of the kitchen is much simplified by utilizing all the space in one particular spot. Such equipment is offered for sale by various makers of interior cabinet work or may be built according to the plan of the housewife by a local carpenter.

Size of Work Spaces

The height of all working areas is extremely important. No general height can be given which will suit all persons. Every housewife must discover the height which is best for herself and see that her work table and sink are installed at this distance from the floor. A few plumbing companies are now beginning to realize that there is no "standard height" at which a sink should be placed and are instructing their plumbers to ask for directions from the housewife. The average plumber, however, installs his sink at a height that is far too low, thereby causing much fatigue for the worker.

TABLE 1.—PROPER LEVELS FOR WORKING SURFACES.

Height of woman	Height of working surface
4 feet 10 inches	32½ inches
4 " 11 "	34 "
5 " 0 "	34½ "
5 " 1 "	35 "
5 " 2 "	35½ "
5 " 3 "	36 "
5 " 4 "	36½ "
5 " 5 "	37 "
5 " 6 "	37½ "
5 " 7 "	38 "
5 " 8 "	38½ "
5 " 9 "	39 "
5 " 10 "	39½ "
5 " 11 "	40 "

The range with the high oven should be chosen in preference to the old type which involves much stooping.

Do not have too wide a work table. A width of 22 inches to 28 inches is sufficient for any work. If a greater width is used, the back of the work space is used simply as a catch-all for various things which should be put in their places. The greater width means more space to be cleaned daily. Most of the cupboards should be shallow also, as this avoids shifting of utensils to find the article at the back. Fourteen inches is wide enough to accommodate the largest dish, but most cupboards may be narrower than this.

Materials

Walls. The walls must be finished with some nard-surfaced washable material. Hard finish plaster painted makes an excellent durable finish. Oilcloth glued to the wall gives an easily cleaned surface which may be replaced or repaired when necessary. Tile is good, but expensive.

While the color will depend upon the exposure of the kitchen, light colors are usually more desirable. They reflect more light, are more cheerful and give an impression of cleanliness. Blue and white are favorite colors which are easily carried out in utensils. A light green is easy on the eyes. Tones of creams and yellows are good if a warm color is desired.

Floors. The ideal kitchen floor is easily cleaned and nonabsorbent of fat, not too expensive, "easy on the feet" after long standing, and not slippery. Hard wood floors are very expensive at the present time. Soft woods are not durable and are hard to clean. A very satisfactory floor covering is good quality linoleum, which may be laid over any type of flooring. Before it is cemented down it should be allowed to lie unfastened on the floor for several weeks to allow it to stretch and shape itself to the space and then be fastened down with a special cement. Brass strips should be placed across doorways or other places where raw edges may receive wear. Corners are more easily cleaned if rounded pieces of brass are placed here.

Table Tops. The material for the table top must be chosen with great care. Hard wood, especially oak or maple, gives satisfaction. Soft wood covered with heavy linoleum is easy to keep clean and is not fatal to dishes dropped upon it. A covering of zinc is durable and is not affected by the heat. It is discolored by acids, however. Oilcloth wears out so rapidly that it is not recommended. Various composition tops, laid over wood, are very durable and are easily cleaned.

Lighting and Ventilation

The kitchen should have at least two windows placed on two sides of the room to give good light and cross ventilation. They may be placed high from the floor to be out of the way of furniture below, but should extend to the ceiling in order to allow easy escape of hot air. The casement window, opening out on side hinges gives the full area of the window for ventilation.

Ventilation is further aided by a hood placed over the range and opening into a chimney or ventilating shaft. By this means cooking odors escape from the room without spreading to the rest of the house. This is especially useful in winter when it is impossible to depend upon ventilation by windows. A small electric fan is an excellent aid to ventilation if electricity is available. Odors may be quickly driven from the room, or fresh air drawn in from the outside. The greatest factor in poor ventilation, especially in the kitchen and laundry, is excess of humidity or moisture in the air. Stirring the air by means of a fan will prevent the humidity being felt.

Artificial lights must be carefully placed so as to direct the light upon the working surface and not into the eyes of the worker. Oven, sink, and work table need special light, placed so that the worker does not stand in her own shadow. It is better to have two or more lights placed to give illumination where needed than to depend upon one general light placed in the center of the room. Bulbs should be shaded if necessary to keep the glare from coming directly into the worker's eyes.

KITCHEN PLANS

A number of kitchen plans have been selected to show how the problem of arrangement has been solved in various types of houses.

Kitchen With Rest Corner

The kitchen in Figure 3 is of medium size, large enough for two or three persons, but small enough for convenience for the single worker. Food is taken from the ice box or from the cupboard, No. 1, above the work area on the left hand. It is placed on the work table near the sink. Utensils are hanging on the hooks above the work space or are taken from the cupboard below. Practically all the preparation of a dish may be done with only a few feet of motion. The range is placed on the right of the work area where it receives side light from the window and where it may be reached with only a short journey from the place where the preparation is done. Dishes for serving are kept in the right-hand high cupboard, No. 2, and the movable table is utilized for serving from either work area, ice box, or range.

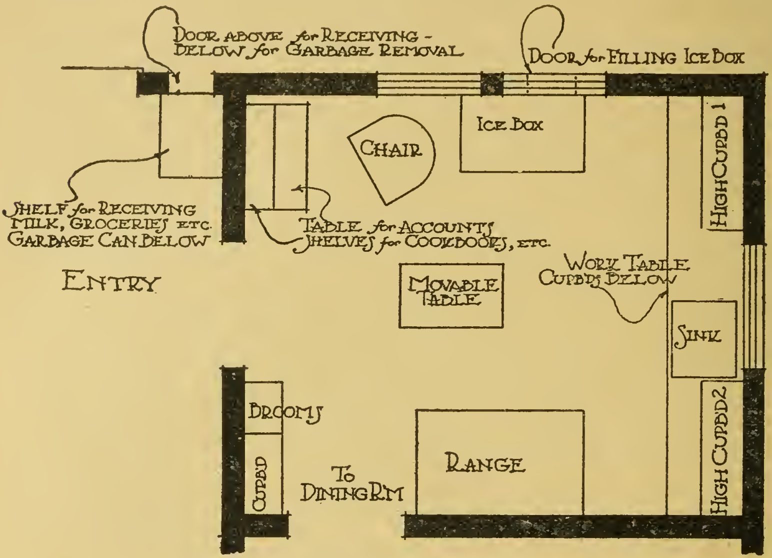

DOOR ABOVE for RECEIVING - BELOW for GARBAGE REMOVAL
DOOR for FILLING ICE BOX
ICE BOX
HIGH CUPBD 1
CHAIR
SHELF for RECEIVING MILK, GROCERIES ETC. GARBAGE CAN BELOW
TABLE for ACCOUNTS SHELVES for COOKBOOKS, ETC.
ENTRY
MOVABLE TABLE
WORK TABLE CUPBDS BELOW
SINK
BROOMS
CUPBD
TO DINING RM
RANGE
HIGH CUPBD 2

FIG. 3.—PLAN OF KITCHEN A

The equipment in this kitchen is well grouped and can be reached with little walking. Other views are shown in figures 1 and 2.

A tea cart may take the place of a movable table and the food be taken directly to the dining room. It is only a step from the place where the food is put into the dishes to the dining room door. In clearing away, the food and soiled dishes are brought out by means of the table or tea wagon. The food is placed in the ice box, soiled dishes are washed at the sink, the utensils replaced in the lower cupboard, and dishes returned to their cupboard, No. 2, on the right.

The work table is adequately lighted, with one window directly above it high enough to protect the glass from spattering. (See

Fig. 1 and 2.) Two windows give side light and make good ventilation possible. These windows are placed high so as to allow space for the ice filling door beneath, so there is no need for the ice man to enter the kitchen or even the house.

In the entry just outside the kitchen door there is a shelf with a small door beside it where the grocery boy or milkman may leave his supplies, thus making it unnecessary for the housewife to be at home when he comes. The food is at once placed out of the sun, and out of the way of dogs and flies. Just below is space for the garbage can where it may be reached without entering the house and yet is readily available from inside. A shelf may be arranged on the door itself, if desired, so that the can swings outside with the door.

The very tiny rest corner is a special feature of this kitchen. There is a space for a small table, where one may consult recipe books or make up the grocery accounts, and a chair with a comfortable back and low arms. Above the table are a few shelves on which cook books and recipe file may be placed, and where there is space for milk tickets, menus, and memoranda pertaining to the kitchen. An extension of the telephone may be placed here, thus making it possible to take care of all telephone calls and to do the ordering without leaving the kitchen.

Broom closet and extra cupboard are in the corner available from the entry and the dining room, yet they do not disturb the main work area of the kitchen.

Figure 2 is a corner of this kitchen showing the compact work area in use. A glimpse of the rest corner with its table, bookshelves and chair is also seen.

Kitchen for General Needs

Another kitchen adapted to general needs is shown in Fig. 4. This is a somewhat larger room, 11 by 13 feet, and is therefore well adapted to the use of two or more workers. If only one worker is to use it, the kitchen may be smaller and the furniture brought closer together. Here the equipment extends around two corners, making a very convenient grouping. Beginning near the hall door is the ice box convenient for filling from the hall. Food may be easily transferred to the work table or washed at the sink. The work table is well lighted and adequate in size, so there is

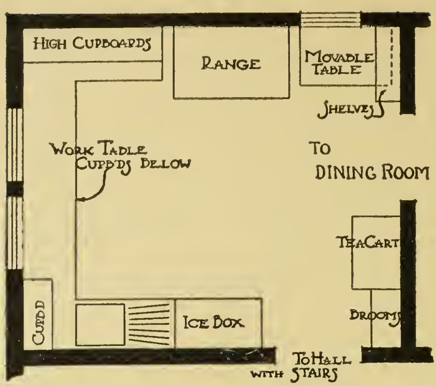


FIG. 4.—PLAN OF KITCHEN B

Work done in this kitchen moves easily from left to right about two corners of the room.

room for salads and other cold food to be prepared near the ice box and sink. Foods which must be cooked may be prepared at the right side and then easily transferred to the range. Dishes for salads and desserts may be kept in the cupboard at the left, while utensils and staple supplies needed for cooking are placed at the right. The movable table near the range may be pulled out into the center of the room or left near the range where it is convenient for serving. The shelves above it are of use for keeping holders, salt, pepper, and other supplies constantly needed while cooking. Below the table is a place for the fireless cooker, so often in the way unless a special place is provided for it. The tea cart, which is, of course, movable, is located in a place available for either kitchen or dining room use. Dishwashing and clearing away are made easy by bringing tea cart or movable table with soiled dishes near the sink from which the clean dishes may be transferred to cupboard.

Another Satisfactory Kitchen

Kitchen C, Figure 5, has been found very satisfactory after a number of years of use. The main work area is under the large window, and is near the large sink on the one side and the range on the other. Cupboards below and shelves above make it possible to have the equipment used for food preparation near at hand as shown in photographs (Figures 6 and 7). The flour bin is swung on a cupboard door to make it easy of access and to

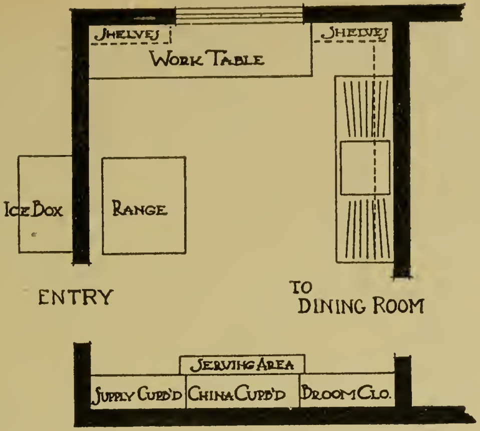


FIG. 5.—PLAN OF KITCHEN C

The working unit of range, work table, and sink with shelves above is here grouped near the large window with the serving area at the other end near the dining room door. These units are pictured in figures 6 and 8.

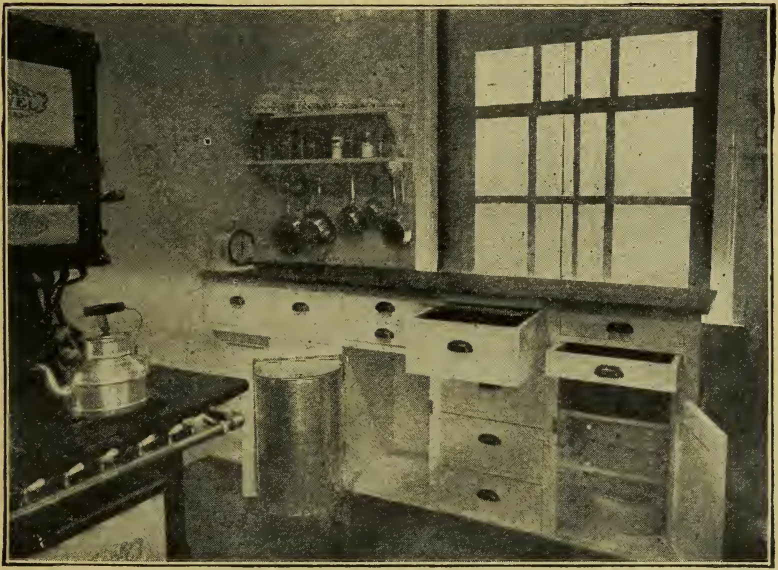


FIG. 6.—GROUPING OF EQUIPMENT IN KITCHEN C

The flour bin which swings on a cupboard door, tin-lined cake and bread drawers and conveniently small cutlery drawers are special features of this work table. The range at the left has a high oven which minimizes stooping.

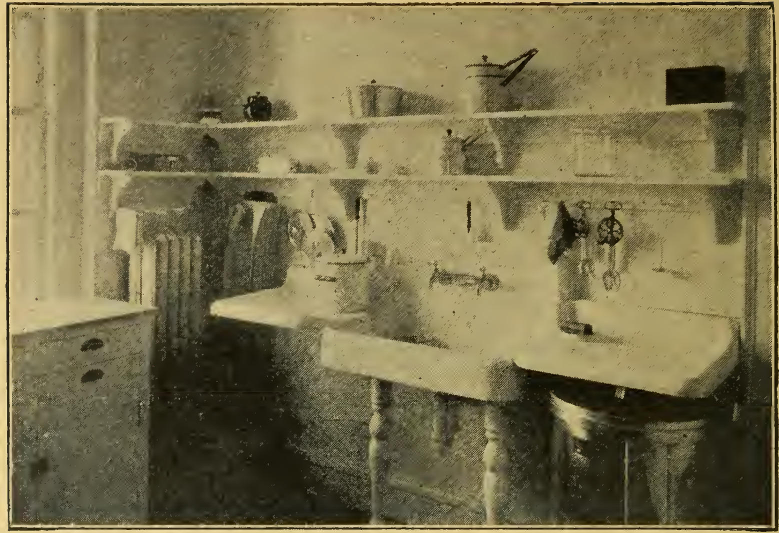


FIG. 7.—ARRANGEMENT OF EQUIPMENT AROUND SINK IN KITCHEN C

Hooks and shelves above the sink place utensils within easy reach of the worker. The sink is placed high so that the worker need not stoop. The corner of the work table shown in figure 6 appears at the left.

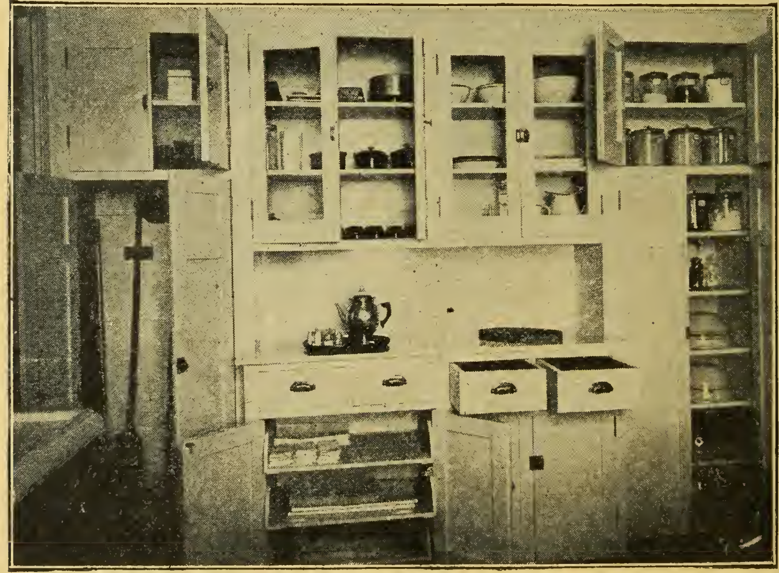


FIG. 8.—A CONVENIENT SERVING AREA IN KITCHEN C

This serving table has felt lined drawers for silver and trays for linen which slide forward on small castors. The higher cupboards open separately so that they need not be opened each time the lower cupboards are used.

facilitate cleaning (See Fig. 6). A storage cupboard for extra supplies is found in the corner near the range. The serving dishes are kept in the cupboard near range and near dining room door, easy of access for either cold or hot food. These cupboards have a serving area where serving dishes may be spread out (see Figure 8). The cupboards below this service area contain sliding trays for linen, and special felt-lined drawers for silver. The sink is near the dining room door so that the soiled dishes are placed on the drainboard, washed in the sink, and returned the very short distance to utensil or dish cupboard.

Kitchenette With Dining Alcove

Planning a kitchenette is a much more difficult problem than the larger kitchen. Since space is limited, any mistake in arrangement is sure to lead to dissatisfaction. Necessarily the equipment must be smaller in size than that of the ordinary kitchen. A kitchenette 6 by 10 feet is shown in Figure 9. The working space is adjoined by sink, ice box, and range; cupboards, and dumb waiter are easily reached. The cupboard between ice box and door is for extra storage, a convenience usually lacking in a very small kitchen. Here the dining space is supplied by the use of the alcove arranged in a small room next to the kitchenette.

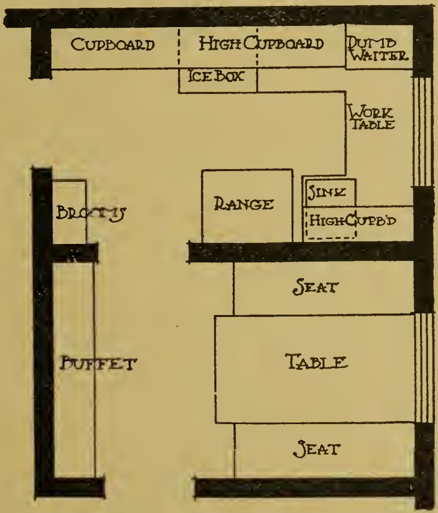


FIG. 9.—KITCHENETTE WITH DINING ALCOVE (KITCHEN D)

In spite of its small size this kitchenette is well arranged for one worker. None of the essentials of a well arranged kitchen have had to be left out.

The dining alcove or breakfast room is increasing in popularity, especially where space must be saved. In Figure 9 there is a table large enough to seat four to six persons comfortably, with built-in bench on either side. The window at the side lights the room amply. A built-in buffet opposite gives space for storage of silver, linen and dishes and is a great convenience in serving. The entire unit of kitchenette and dining alcove occupies a space only 10 by 12½ feet and is consequently adaptable for use in apartments or small houses.

Farm Kitchens

The farm house kitchen is a special problem. Necessarily many more types of work must be done in or near the kitchen. Frequently much of the cleaning incident to dairy work is done in the house. The laundry work is practically always done at home. If several men must be fed, it is especially necessary that there be an adequate place for disposal of coats, overshoes, and the like and that facilities for washing are easy of access. Too often

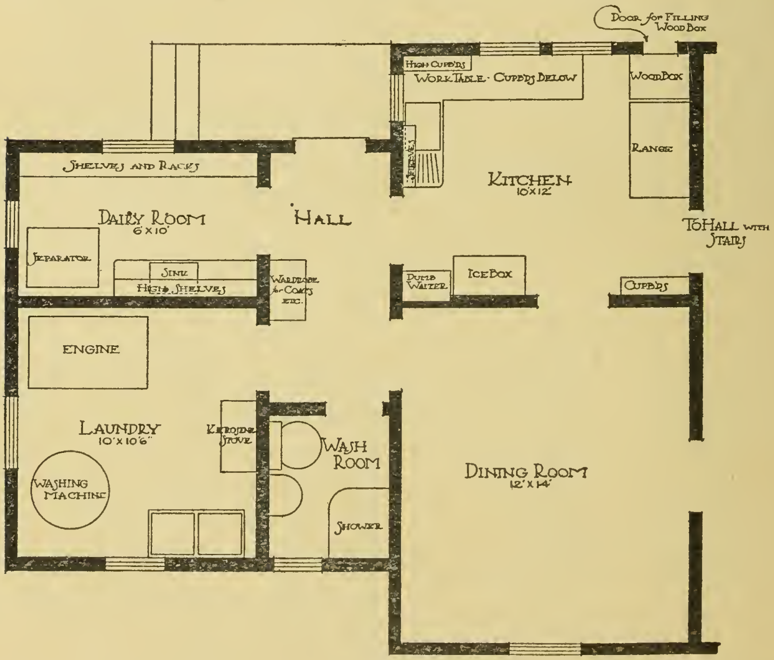


FIG. 10.—KITCHEN E REPRESENTS A FARMHOUSE SERVICE UNIT

Dairy room, laundry and wash room are entirely separate from the kitchen and are easily reached from the back door. The kitchen work of food preparation proceeds undisturbed.

the kitchen of the farm house is made to serve as a dairy room, laundry, wash room, coat room, as well as a place for meal preparation and possibly a dining room.

If possible in planning the farm house, separate space should be arranged to take care of these various activities, leaving the kitchen for food preparation alone. This has been done in kitchen E. Figure 10, by building a service unit as a one-story adjunct to the house in which the dairy work and the laundering may be taken care of without disturbing the kitchen. This service unit is so closely related to the kitchen and dining room that few steps are lost in reaching it.

The entrance from the barns and back of the house leads to a small hall from which the other rooms may be reached. The kitchen is readily available, yet need not be entered to reach the other rooms. The dairy room provides a space for the separator, run either by hand or by power provided by the engine in the laundry. Near it, lighted from the side, is a sink with large drainboards on either end where all dairy utensils may be washed. Narrow shelves and hooks above provide storage space for many of these. On the opposite side of the room are racks for milk cans and pails and shelves for bottles, separator parts, and other dairy necessities. The dairy work is thus entirely separate from the rest of the rooms.

Next to the dairy room is the laundry 10 by 10½ feet. This has space for the engine which by means of a line shaft, run near the ceiling through the wall, provides power for the separator and for the washing machine. The washer is placed between the two windows so as to receive a good light. The tubs are near it so that clothes may be taken from one to the other with the minimum of walking. The clothes are boiled on a kerosene stove near the tubs. The grouping allows one, two or three persons to work efficiently in the laundry without getting in each other's way or wasting time or energy by extra walking.

A wardrobe in the hall provides a place for hanging the men's wraps. The washroom is near at hand, and the men may come in from outside, wash, and go into the dining room directly. The wash room contains a shower in addition to the usual bowl and closet, in order to make it easy for the men to wash when coming from work—a great satisfaction and comfort on a farm. A shower is less expensive than a tub, takes up little space, is pleasant and quick to use, and is easy to clean and keep sanitary.

The kitchen itself in this service unit need not be larger than any other kitchen since it is primarily a place for the preparation of food. The work table is of the compact space-saving type pictured in Figures 1 and 2, with the sink at the left end under a window. Shelves above the sink, and a cupboard above the work table provide storage space for utensils, dishes, and staple supplies needed for preparation. Extra storage is provided by the small cupboard near the dining room door. Near the work table is the range with the box for fuel in the corner. Much dirt and confusion are spared the kitchen by providing a door through which the woodbox may be filled from the outside. Food preparation and cooking are thus done on one side of this kitchen and it is only a short distance from the range to the dining room for serving. The dumb waiter is built into the corner of the kitchen and food may be raised from the cellar easily. The clearing-away process is easily done at the sink, ending by putting away the dishes and materials on shelves and cupboards.

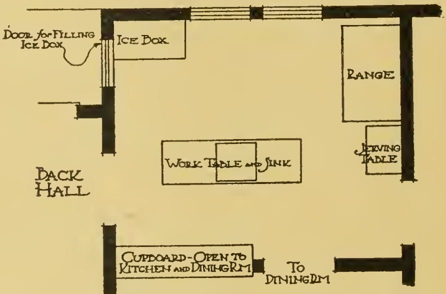


FIG. 11.—FARMHOUSE KITCHEN WITH WORKTABLE IN CENTER (KITCHEN F)

The room is divided into two areas by the worktable—preparation and cooking on one side and serving and dishwashing on the other.

For those who prefer to have their working space in the center of the room, Kitchen F, Figure 11, may be used instead of E, in the farmhouse service unit. Here the refrigerator has been moved under the window where it may be filled from the outside. From the icebox, food may be placed on the work table which with the sink and cupboards below is in the center of the room. The sink may be covered with a hinged top which when closed is flush with the rest of the table top and increases the size of the work table. Cooking is done at the range which is within easy reach of the work area. The serving is done from the range to the shelves and movable table, and thence the food goes to the dining room. Food which is not warm may be served through the cupboards which open into both kitchen and dining room. Soiled dishes and food may be returned through the cupboard or placed on the movable table which is brought to the sink where dishes are washed. An advantage of such an arrangement is that work may be done on all sides of the work table. Furthermore, the kitchen is divided into two portions of the central work space—the part near the windows is the preparation area, that next to the dining room the serving and dishwashing area.

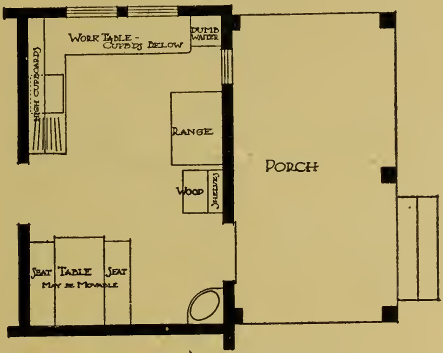


FIG. 12.—THE FARMHOUSE KITCHEN-DINING ROOM (KITCHEN G)

The men may come in from outside, wash and eat without disturbing the work area at the other end of the room. The porch may be used as a dining porch in summer. The dumb waiter in the corner will save many trips to the basement.

Small Kitchen also a Dining Room

In the smaller farm house the kitchen may need to serve more purposes. In Figure 12 is shown a kitchen which is also the dining room. The work area is concentrated in one end near the group of windows. The dumb waiter is convenient to the work table which adjoins the sink. Cupboards above offer space for storage of dishes and food. The food is prepared here, cooked at the range, and served at the table at the other end. Shelves above the fuel box are used as aids in serving. The table may be a movable dining table with chairs but space is saved if the built-in type of table is used with built-in benches which may be fixed or movable as desired. It is usual to have the sides of the table hinged a few inches from the table edge in order to make access to the seats more easy by dropping the table edges. The men enter from the outside, wash at the lavatory in the corner near the door, and sit down at the table without disturbing the work area at the other end of the room. The wood box is near the outside door so it may be filled without difficulty. A door might be cut through to the porch to allow filling from the outside if desired. For a large part of the year, it would be possible to use the porch as a dining room, serving through the window by the range or through the outside door.

The same type of problem is shown in Kitchen H, Figure 13. Entrance is made into a small vestibule from which one may go to the basement. This hall contains a closet-like alcove where there is a box for the men's overshoes, with hooks for coats above. A lavatory is placed here, easy of access from the kitchen and from the outside.

The work space is grouped around two sides of the kitchen and is well lighted from two sides. All the equipment needed—work table, cupboards, sink, icebox, range—is found in small space but is not crowded. The dining table is movable, with drop leaves so that it may be pushed back when not in use, taking very little space. Broom closet and closet with ironing board are set into the wall near the table.

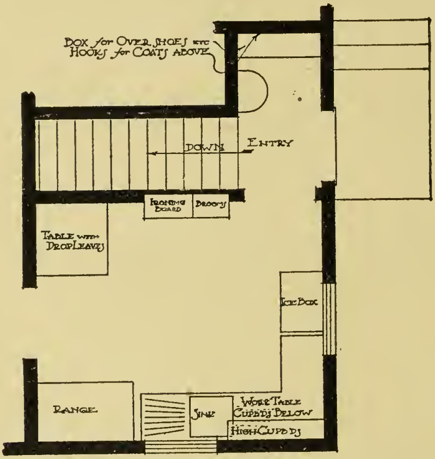


FIG. 13.—KITCHEN FOR THE SMALL FARMHOUSE (KITCHEN H)

The working space is compactly grouped near the light. The drop leaf table in the opposite corner may be pulled out into the kitchen and used for the dining table. Entrance to the basement and access to washbowl and coat hooks are easy either from the outside or from the kitchen.

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Circular 157 January, 1923

FIRST AID TO FARM PROFITS

ANNUAL REPORT OF THE
EXTENSION SERVICE OF
THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN
MADISON

MERCHANDISING will doubtless soon become the greatest aid to farm profits. It is soon to be given new meaning in agriculture where it will signify the converting of painstaking effort in production into greater profits which in turn will mean better homes and better communities.

Good merchandising is built upon the solid foundation of producing something to sell that is worth selling. It begins with a quality product in sufficient quantities to meet any demand that may exist or be created. It means a product of distinctive nature—one that may be identified by a well-chosen trade name. It means a product that is worth selling to the consuming public. This means that it must be advertised intelligently and economically. Consumers must be made to think of this particular product above and before all others. When they ask for it they should be able to get it easily, promptly, and in a form suitable to their needs. That means service and *service* is the one great watchword of successful merchandising.

Merchandising will be the farmers' way out of many of our present difficulties if more of the premium which the consumer pays for a superior product is passed back to the producer. It is not a "first aid," but it is destined to become an effective and enduring Aid to Farm Profits.

First Aid to Farm Profits

H. L. Russell and K. L. Hatch

HAVE WE EVER had a profitable agriculture? Probably not. Farming as an industry never has been consistently and steadily profitable, though here and there individual farmers have made money. Agricultural wealth is due more to rise in land value than to profits actually accumulated on the products of the soil.

Are we ever to have a profitable agriculture? Farming must become generally profitable or else in the midst of our boasted democracy we will have a peasant people on the land. There are no two ways out. Standards of living in the country must be kept on a level with city life. In this hope lies the only future of American agriculture and country life.

But how can it be done? The profits of agriculture, as well as everything else, arise from a favorable difference between cost of production and selling price. Over prices the individual farmer has little control. It is only by powerful organization for orderly marketing of farm products that farmers as a class can influence prices. The individual farmer is helpless.

What Then Can He Do?

Over-production is the "thorn in the flesh" of agricultural progress. Let farmers as a group produce more of any particular product and their successful efforts are immediately offset by lower prices. But let the individual produce more per acre and it is his individual over-production that makes profit for him. To him "over-production" per acre is of equal if not greater importance than market price, for no matter what the price the *profit* is always the excess of price over cost of production. If the price is so low that with good yields no profit results then it is high time to compare this with other crops that show a balance on the right side of the ledger. This means that on certain Wisconsin farms some crops can be bought cheaper than they can be grown. There certainly can be no profit in raising such a crop. It further means that

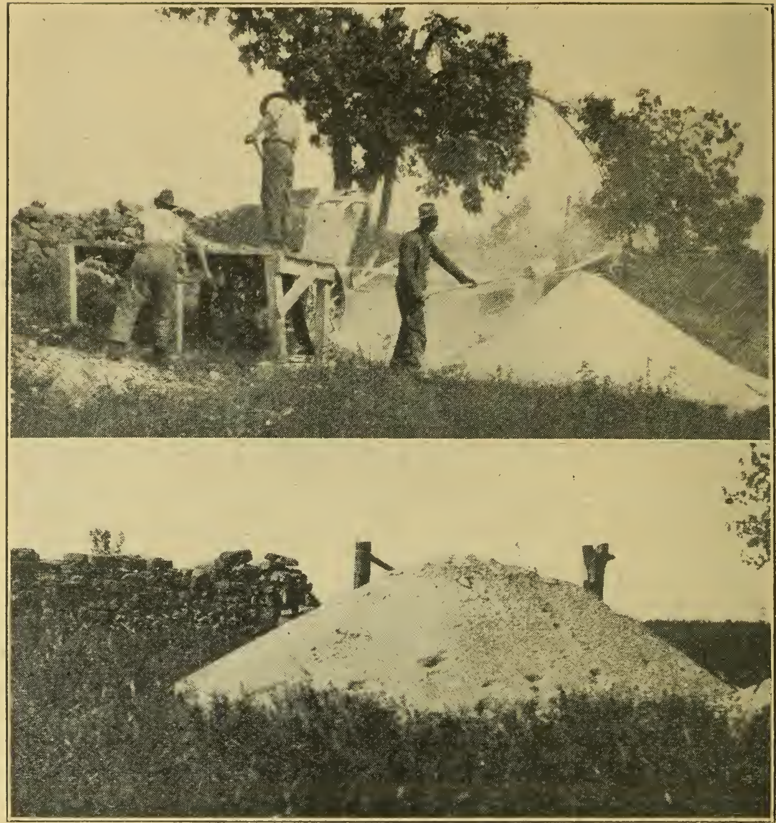


FIG. 1.—STONE FENCES TORN DOWN TO BUILD UP SOILS.

Witness the change in agricultural thought. In the pioneer days our grandfathers' fences of lime rock were built as permanent enclosures for live stock. Today they are being ground to dust and put back on the land to grow alfalfa—a crop that our worthy ancestors knew naught of.

on other farms some crops can be grown to greater advantage than those now being raised. In either event certain crops should be replaced by others that can be more profitably grown.

In these times of stress no farmer can expect to make profits unless he produces those crops that will yield him the largest net return for each acre of his farm.

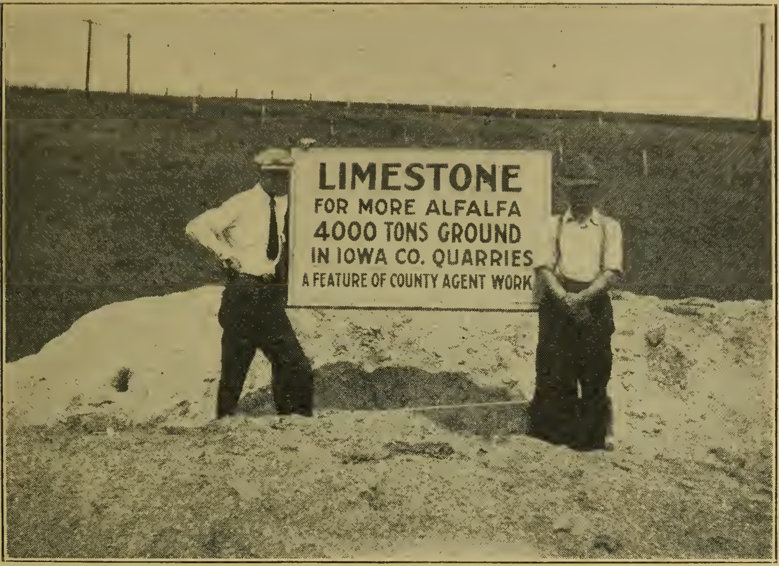


FIG. 2.—IOWA COUNTY IMPROVES ITS FORAGE.

The growing use of ground limestone is rapidly increasing the acreage of alfalfa—"the wonder crop"—on farms all over the state.

Crops That Work Hardest for Us

Not the least among these is alfalfa. All the oats, wheat, rye, corn, or barley grown on the average acre of land in the Central West can be bought for twenty dollars but it takes more than twice that amount to buy the alfalfa that can be grown on this same acre! Why not grow crops that work hardest for us—that produce the most feed for us—that make the most milk for us—that yield the largest net returns for us in feeding value, in soil enrichment, or in dollars and cents? This is one basis for the increasing efforts of the agricultural extension service to improve conditions and maintain standards of living on Wisconsin farms.

Alfalfa a Profitable Crop

Every ton of home grown alfalfa is protected by a high tariff likely to be more or less permanent, in the form of high transportation costs on this bulky product produced in distant states. Millions of dollars are expended every year by Wisconsin farmers for hay and feed that can be grown at home at much less cost. Why not grow our own alfalfa?

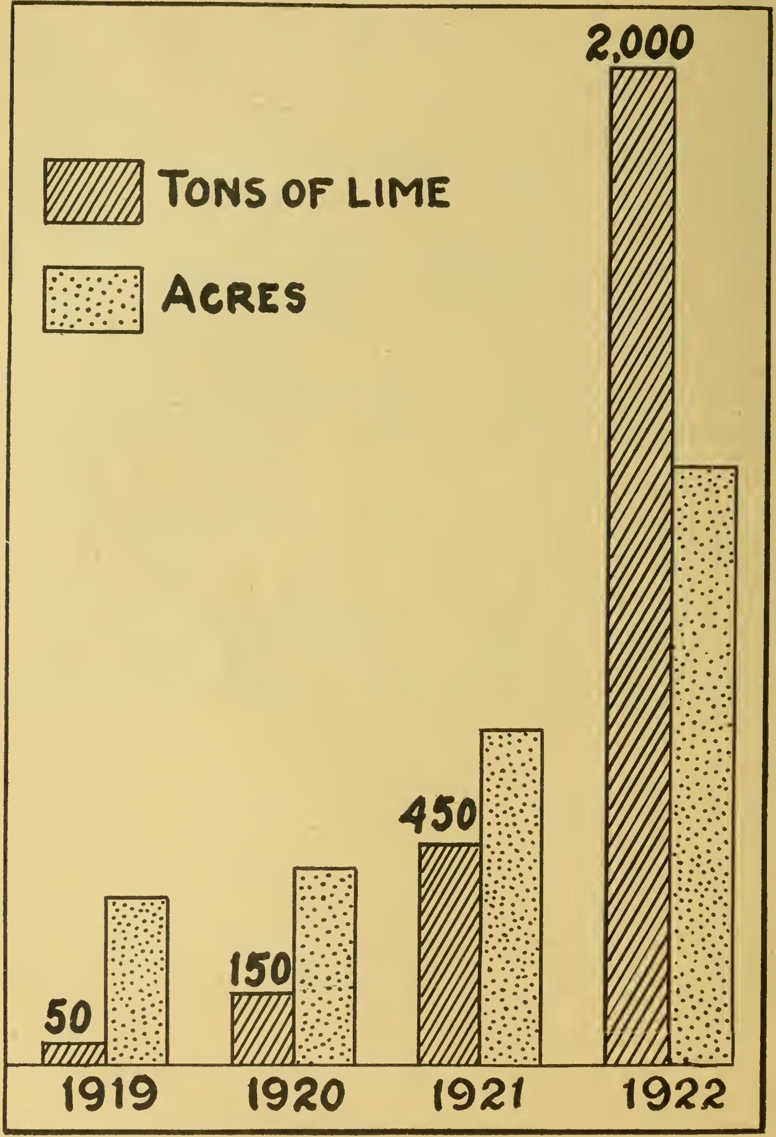


FIG. 3.—LIME APPLICATIONS PRECEDE GROWTH OF ALFALFA

In 1922 Green Lake county farmers had 2,000 tons of limestone ground and their alfalfa acreage doubled that of 1921.

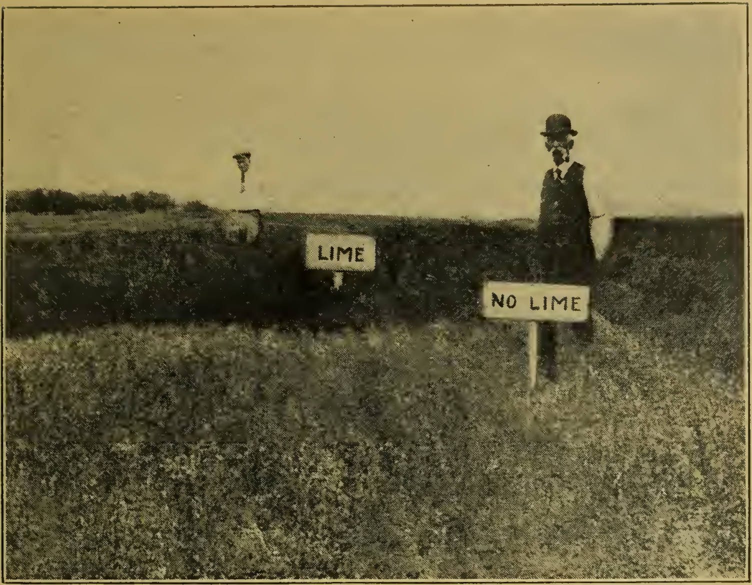


FIG. 4.—YES, LIME MADE THE DIFFERENCE.

This picture speaks for itself. Where no lime was applied the alfalfa growth is weak and scanty. On the other field where lime was used it is "hip high."

Farmers Learn How to Succeed With Alfalfa

The increasing use of lime on alfalfa land has been noted for the past five years. This movement has been fostered alike by college specialists and county agents and has been an important factor in increasing alfalfa acreage during this period. Iowa County now has two local grinders at work with an annual output of 6,000 tons; Green Lake has one machine that has turned out 1,500 tons in the past six months; Green County has produced 8,000 tons; Walworth, which has just begun grinding, has already turned out 1,000 tons; while Rock, with four machines, has ground 14,000 tons in the past two years. By this method of local grinding the farmer eliminates the long haul and has his supply of limestone easily available for convenient use in time of need.

Through the use of alfalfa campaigns, auto tours and demonstration fields the acreage of alfalfa in Wisconsin is rapidly expanding and "pushing up the profit line."

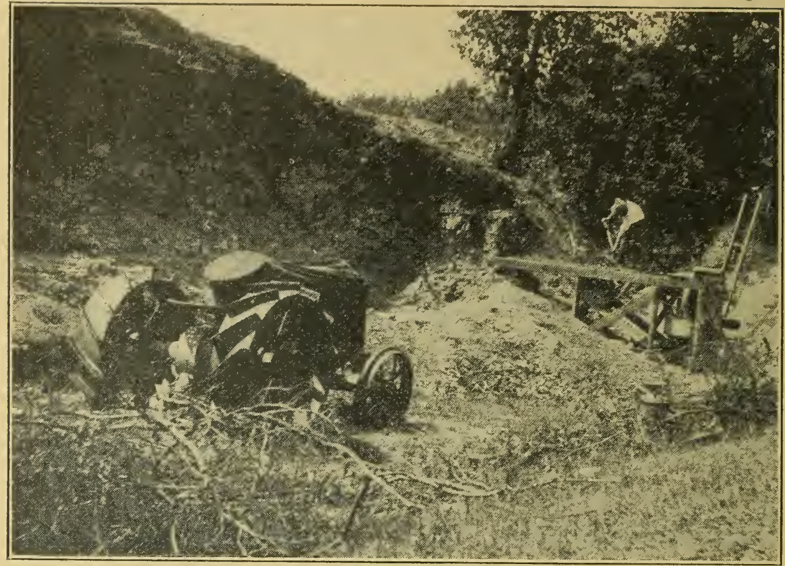


FIG. 5.—A ROCK COUNTY LIME GRINDING OUTFIT.

Four of these local machines ground 14,000 tons in Rock county in the past two years.

Beekeepers Boost Better Business

The object of demonstration work in bee-keeping is not to encourage more men to engage in beekeeping but to increase the production per colony—the only way the individual producer can increase his profits. By establishing grades and standards and by organizing for better marketing, beekeepers may secure better prices for their product; but this will not necessarily affect the volume of business which each producer is able to do. Better prices combined with higher production of quality products for each colony kept is the aim of Wisconsin beekeepers.

The average increased production per colony obtained in eight demonstration yards was 46 per cent ranging from 12 per cent the lowest to 75 per cent the highest. This increased production, due to better management, was obtained at relatively small expense so that it becomes a favorable factor on the profit side of the ledger and is within the reach of every beekeeper.

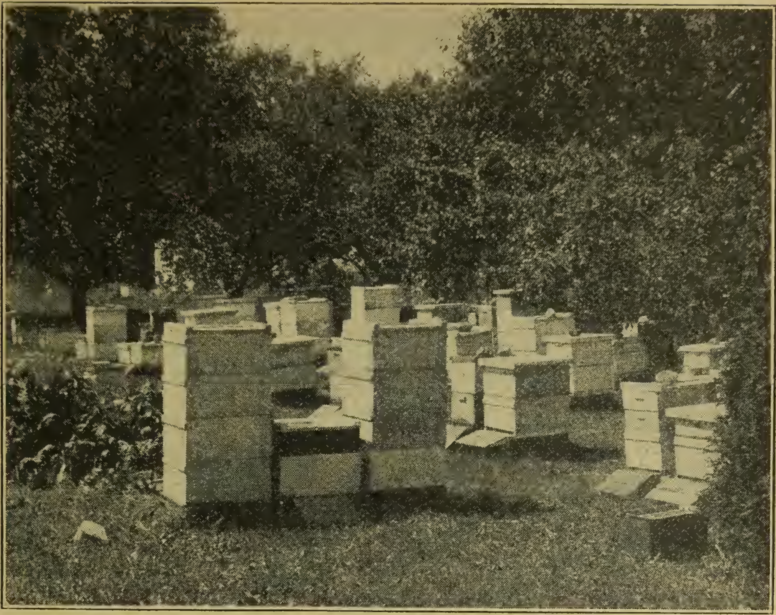


FIG. 6.—GIVE THE BEES ROOM.

Honey production is encouraged by adding space for the bees to work in. Photo shows apiary of I. A. Travis, Elkhorn, who is using up-to-date methods.

Boys and Girls, "Beginning" Farmers

In spite of the depressed farming conditions which have led many a parent to say, "I do not want my child to be a farmer," over 15,000 Wisconsin boys and girls have taken up "Club Work" during the year. Over 1,500 dairy calves have been fed, managed, and exhibited by club members during the year, 1,200 of which were purebred and 500 of these on farms which never before had had a purebred animal.

Paul Zink of Alma Center raised 108 bushels of corn on a single acre while Orton Day of Janesville cleared $90 over and above all expenses on his acre from the sale of seed corn. In Buffalo County, 103 boys are prepared to supply the county with seed corn. Bernice Ross of Taylor purchased a Jersey heifer for $35, exhibited her at fairs, winning over $90 premiums, and then sold her for $150. Conspicuous examples such as these convince some of the young people that there are

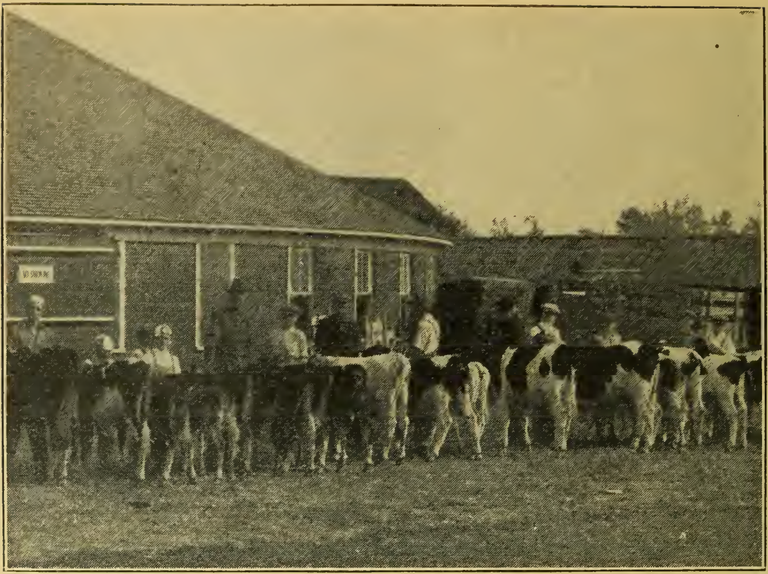


FIG. 7.—THE WOOD COUNTY CALF CLUB.

"Bring a child up in the way he should go and in later years he will not depart from it."

still profits in farming if one knows how to find them and they do much to counteract the influence of parents who do not want their children to stay on the farm.

So favorably has the club work been received all over the state that many county fairs have added club departments.

At La Crosse 69 calves and 50 pigs were shown by club members, while at Jefferson 67 calves were exhibited. What club work is doing to make "fairs for farmers, not for fakers," is no longer a matter of conjecture.

Cow Testing Catches Culprit Cows

Low prices of dairy products have taken much of the enthusiasm out of Wisconsin dairymen but culprit cows have stolen the profits, so cow testing reveals. To show a profit under present conditions a cow must produce more than the average. If 30 per cent of so-called dairy cows were sent to the shambles the product of the remaining number would show a larger profit. We pride ourselves on the fact that Wisconsin has

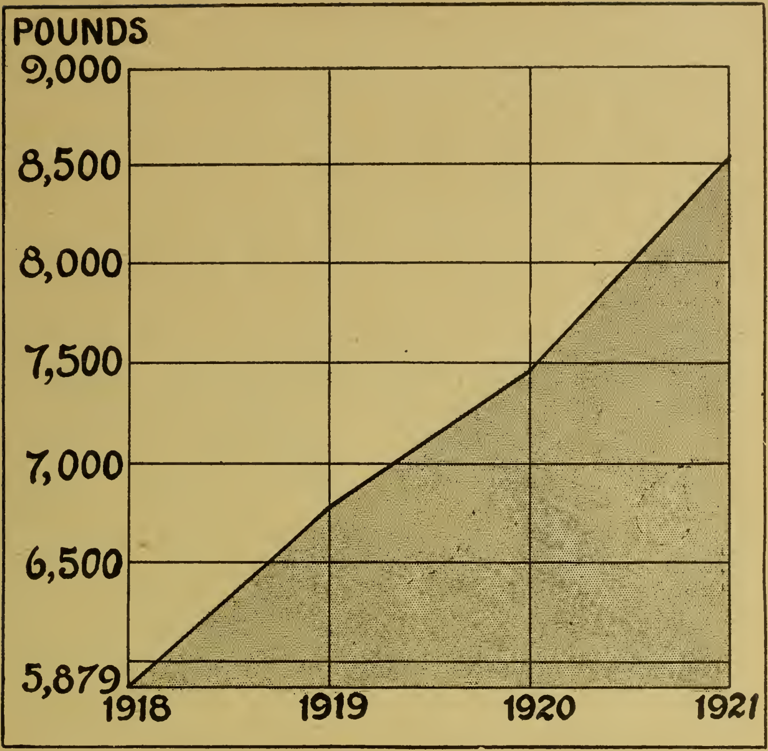


FIG. 8.—COW TESTING ASSOCIATION WORK IN IOWA COUNTY.

Ten herds (285 cows). Average increase in production per head 2657 or 99.0 pounds of butter fat. With milk at $1.45 per cwt., this amounts to over $10,000 or $1,000 annual increase in the income per herd.

more dairy cattle than any other state but we have to acknowledge that Wisconsin is carrying thousands of profitless dairy cows.

The average fat production of Wisconsin cows is about 180 pounds, hardly enough to pay for their keep. Continued testing over a period of years always raises the average. Take the case of H. O. Aavang of the Barneveld Cow Testing Association. Five years ago his herd averaged 190 pounds of fat each, just a little better than the average of Wisconsin herds. Last year, after four years of testing of his herd the average was raised to 266 pounds. All the profit he has had out of his herd has come from this increase!

Again, take the case of Olin Ruste, owner of the high herd in this same association. Five years ago Mr. Ruste's herd produced an average of 244 pounds of fat but last year's record shows he raised this to 431 pounds, an increase of 187 pounds per cow, practically all of which was profit.

Does continued testing pay? It did pay in the case of Mr. Ruste and hundreds of other men who have continued testing over a period of years.

Not only that but cow-testing reveals the results of good feed, care and management. Take the case of R. L. Raymond,

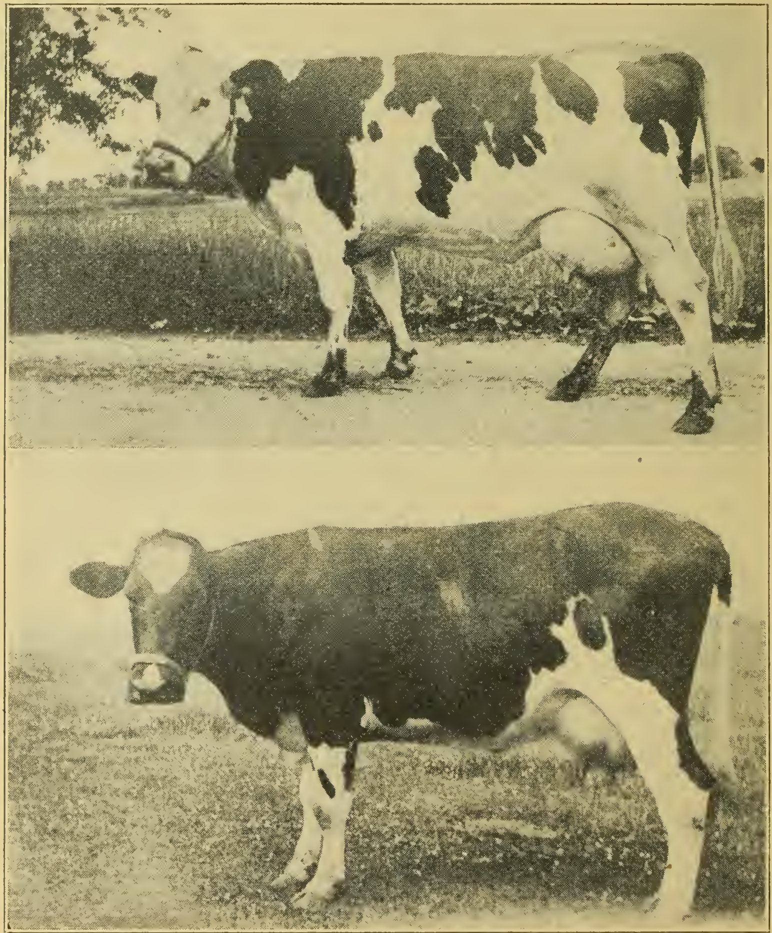


FIG. 9.—CHOOSE THE BEST COW.

These cows are half sisters, both "pure-breds" and both by the same sire. One gave 254, and the other 363 pounds of fat. Can you pick the winner? "Test, don't guess."

Campbellsport, Wisconsin. Last year Mr. Raymond secured an average of 450 pounds of fat each, on a herd of 31 grade cows! This of course was not due to testing alone but also to good feed and good care bestowed upon the herd by the owner. While other dairymen may have lost money at the business it is certain that Mr. Raymond, by securing high production from each individual unit in his herd, was able to show a profit.

"High producing units" are a better answer of the individual farmer to the profit making question than are "high prices."

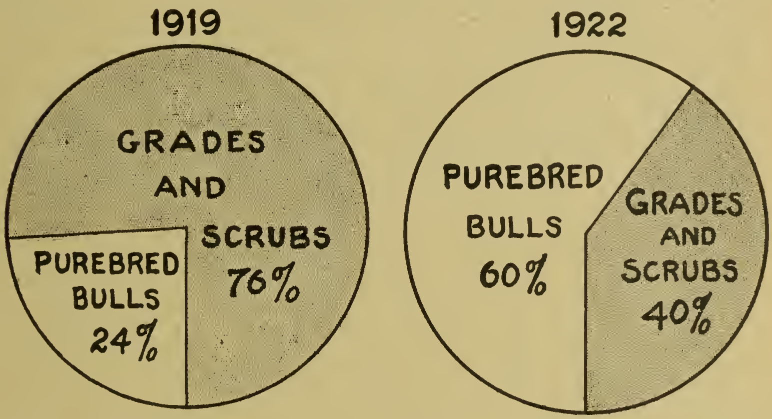


FIG. 10.—FOUR YEARS OF LIVESTOCK IMPROVEMENT WORK IN GREEN LAKE COUNTY.

If Green Lake county continues its efforts to improve its dairy stock another five years will see every dairy herd headed by a pure bred sire.

Dairy Cattle Demand Continues

There can be no profit in keeping unproductive surplus stock on the farm. For such, a satisfactory market must be found. It has been the consistent purpose of the college to stimulate such a demand from other states. Through letters to bankers, county agents, and others in neighboring states, through a quiet but intensive selling campaign, directed toward those sections of the country where dairying is rapidly developing, not only by the college but also by the various livestock organizations within the state, Wisconsin succeeded in disposing of 30,000 head of dairy cattle during the

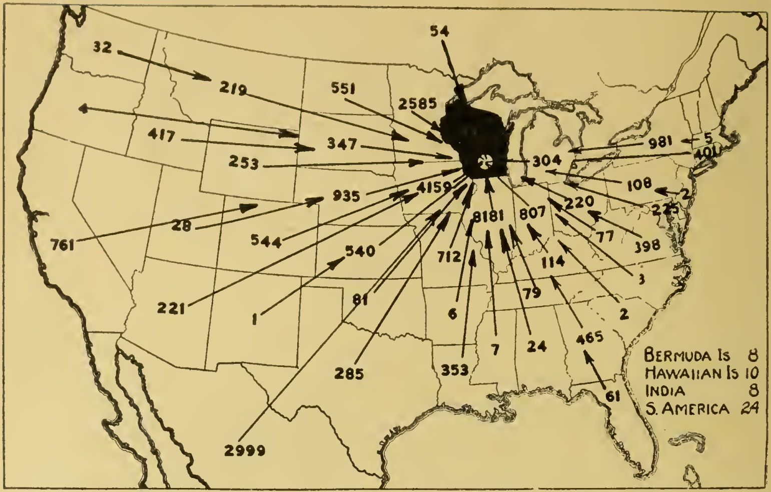


FIG. 11.—WHERE WE SENT OUT CATTLE.

Despite hard times, Wisconsin farmers last year scattered 30,000 dairy cattle all over the western hemisphere.

year to outside buyers. While prices were not high, there is no question but that they were much higher than they would have been had this outside market not been found. Here again quality counts. The best evidence is furnished by a single example. At the last National Dairy Show, 40 head of Wisconsin grade cows, every one of which had a cow testing association record of over 365 pounds of fat for the year, were sold at public auction at an average price of $150 per head. During the same week an outside buyer received the same quality of grade cows, but *without records,* by private purchase at $84 a head. This difference in price fairly represents the difference between proven and unknown production and under present conditions is the dairyman's only hope of profit on the grade cattle market.

Higher Production from Drainage

There can be no profit from unproductive land, and land that is only half producing is likely to be a liability. The only way for the individual farmer to stop these losses is to get this land into production.

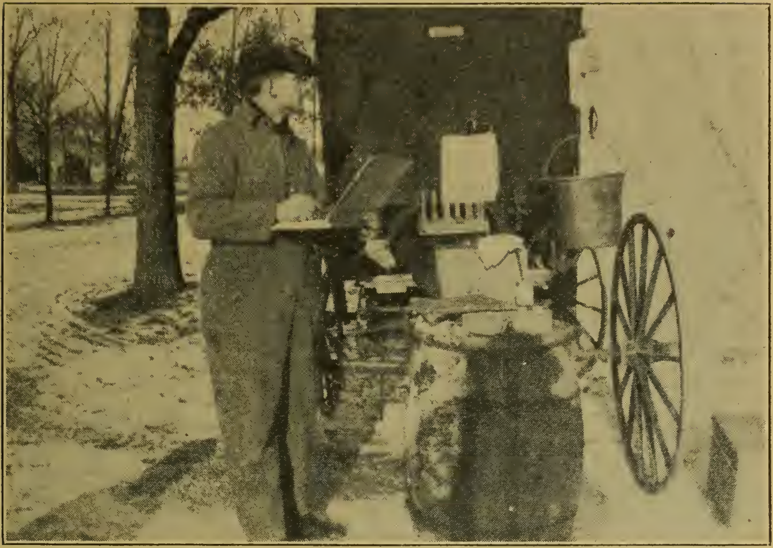


FIG. 12.—MAKING THE ROUNDS.

C. T. Bragg, tester Fort Atkinson Association and his testing equipment. "The old horse and buggy is good enough for me."

Much land fails to produce because it is too wet. To drain such land requires an outlay of money which under present conditions is hard for farmers to get. As a result there has been less drainage activity than in former years. Nevertheless plans for twenty drainage districts comprising over 87,000 acres and involving a total final outlay of over a million dollars for drainage improvements has been worked out for farmers during the past year. Since the completion of these systems requires the organization of farmers into groups for the main ditches as well as the individual drainage work on each separate farm it will necessarily be some time before these projects can be finished. In addition to this, 38 different farmers have had preliminary surveys made for drainage on their own farms by the drainage specialist and the county agent.

A special line of work in preventing soil erosion—another destroyer of farm profits—was started in the rougher section of Buffalo County where both roads and fields are being ruined. Unless these losses can be stopped there can be no profit in farming such land.

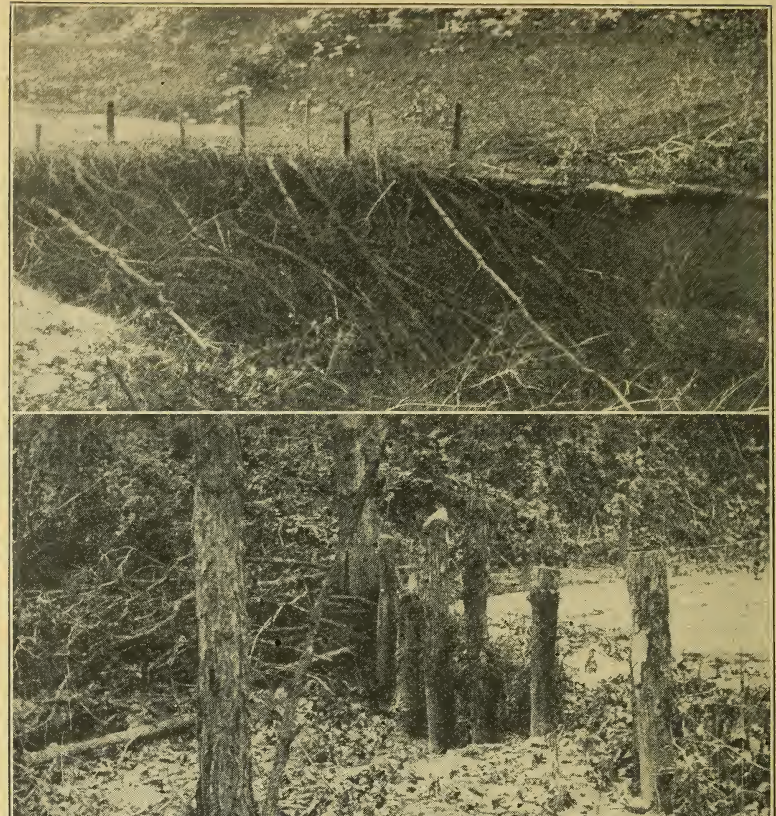
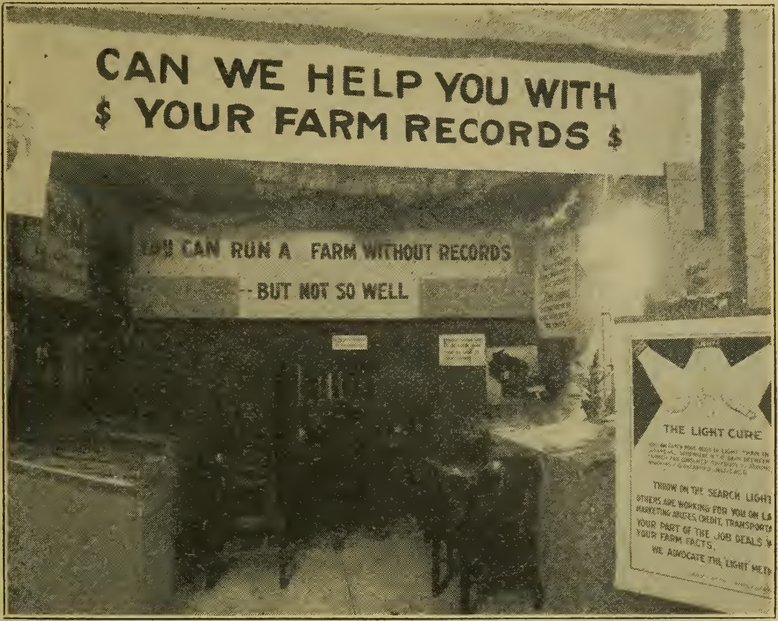


FIG. 13.—TWO WAYS OF DEALING WITH THE EROSION PROBLEM.

Erosion is checked by placing a retarding dam across the natural water course, but it is greatly hastened if the channel is plowed.

Farm Records Determine Profits

No farmer can tell whether the various branches of his business are profitable or not unless he keeps records. Neither is he able to abandon a losing venture and to take up or expand a paying one if he has no record of either. It is for exactly these purposes that farmers are being continually encouraged to " keep books."


CAN WE HELP YOU WITH
$ YOUR FARM RECORDS $
YOU CAN RUN A FARM WITHOUT RECORDS
--BUT NOT SO WELL
THE LIGHT CURE
THROW ON THE SEARCH LIGHT
OTHERS ARE WORKING FOR YOU ON LA
MARKETING, PRICES, CREDIT, TRANSPORTA
YOUR PART OF THE JOB DEALS W
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WE ADVOCATE THE LIGHT METH

FIG. 14.—A STATE FAIR EXHIBIT.

Yes, you can run a farm without records, but you can't tell whether your business is profitable or not unless you "keep books."

That many are taking the necessary steps to determine actual costs of production is shown by the fact that over 3,000 Wisconsin farm record books have been put into use on as many Wisconsin farms during the past year, in all but two counties of the state.

Farmers' Institutes Furnish Incentive

Without the inspiration that comes from contact with others, the exchange of ideas, and the adoption of new methods, farmers are slow to change even for the better. Farmers'

Institutes furnish the necessary incentive for the adoption of more profitable methods. Men trained in scientific details, accompanied by others skilled and successful in practice, teach and lead groups of farmers assembled in meetings and institutes in more production and hence more profitable farming. Nearly 400 such meetings scattered throughout the entire state gave opportunity for the county agent, college specialists and practical farmers to meet and plan for more profitable production. The means by which results are actually accomplished may best be illustrated from the single case of an institute held at Fall Creek in Eau Claire County.

During the Institute E. S. Leverich, the county agent, tested 25 samples of soil acidity, while J. L. Zieman, a leading farmer in that vicinity secured a list of names of farmers who wanted assistance with the following problems:

Twenty-six farmers wanted further information about soybeans.

Thirteen ordered soybean seed.

Thirty-three wanted further information on silos.

Fifteen wanted a cow-testing association.

Nine signed up for a fruit spraying ring, and

Twenty-two united in ordering 121 tons of ground limestone.

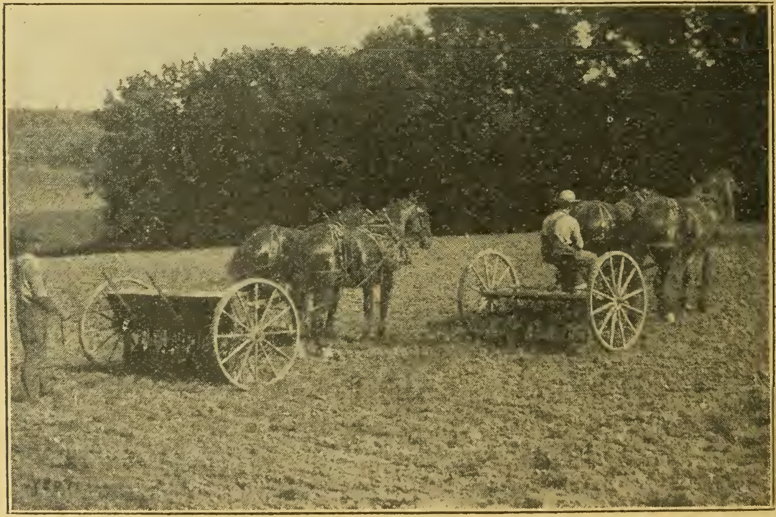

FIG. 15.—JUST A COMMON CROP.
Soybeans are planted with ordinary farm machinery, tended and harvested in the same way.

When this demand is followed up as it is by the county agent, farmers have not only taken the first step but are a long way on the road to improved agriculture. If indifference is changed to action by a new idea, other suggestions easily take root and grow.

Field Crops Fix Profits

Granting that *prices* are fixed by forces beyond the control of the individual farmer, it does not follow that *profits* are sc fixed. The farmer himself still has the opportunity to fix his own profit by securing the highest unit production possible.

Take the case of soybeans, for example. Unoccupied sandy land cannot produce a profit and cultivated sandy land will not show a profit unless planted to the right kind of crops. For profitable production on light sandy soil there is no crop more promising than soybeans.

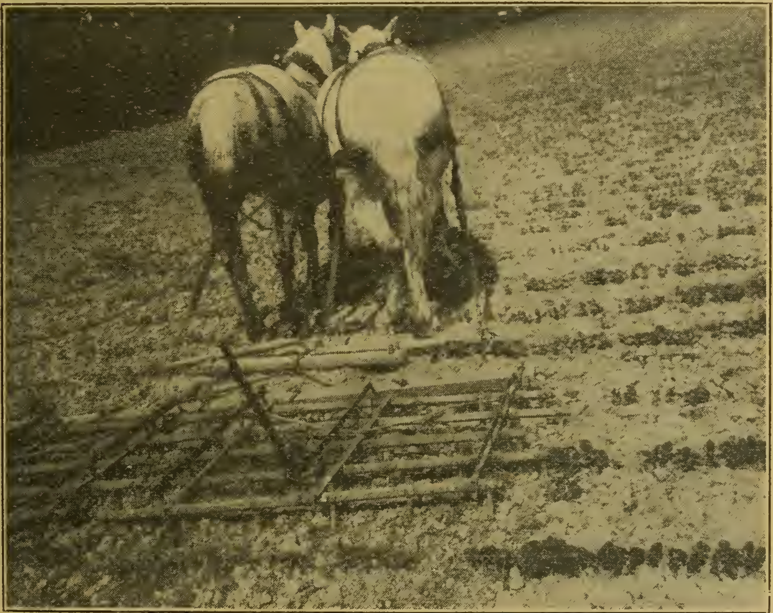

FIG. 16.—KILLING WEEDS WITH THE HARROW.

The best time to kill weeds is when the beans are about five inches high. An ordinary harrow is a suitable tool.

This point is clearly illustrated by a comparison of a 5-acre field each of oats and soybeans:

5 acres of oats—30 bu. acre—150 bu. @ 40c	$ 60.00
5 acres soybeans—8 tons of hay @ $20	160.00
Difference in favor of soybeans	$100.00

What would this mean if the several million acres of "light" soil in central Wisconsin could be put to work in profitable production!

What is true of soybeans is also true of hemp, another new crop and every other important farm crop where pure bred seed gives a higher yield than the seed in common use.

Land Clearing Key to Farm Profits

Any large amount of land brought into cultivation would doubtless increase production and thus depress prices. But the land clearing work is designed to bring into cultivation idle acres on small individual farms. The resulting production does not find its way into the channels of trade but is largely consumed on the farms where it is produced. Hence it does not depress prices but raises the standards of living of the producer. This is the goal that is sought in the cut-over areas.

That a land clearing campaign is necessary is shown by four basic facts:

1. Food consumption in this area is far in excess of production.
2. Large importations of rough feeds for maintenance —not production—of herds and flocks.
3. Rapidly increasing population without corresponding increase in dairy cows.
4. Lack of balance in farm operations which makes it necessary for many farmers to seek other employment in order to provide the barest necessities of life.

All these statements are matters of common observation and have absolute statistical proof as well. Such farms cannot be profitable and never will become profitable until much larger acreage is under plow. The biggest hindrance to cultivation is the pine stump which is most quickly and economically removed by use of explosives. An additional supply of picric acid was secured through the U. S. Bureau of Public Roads, and was disposed of in 62 counties at cost of cartridging and distribution. This distribution which resulted in a saving to

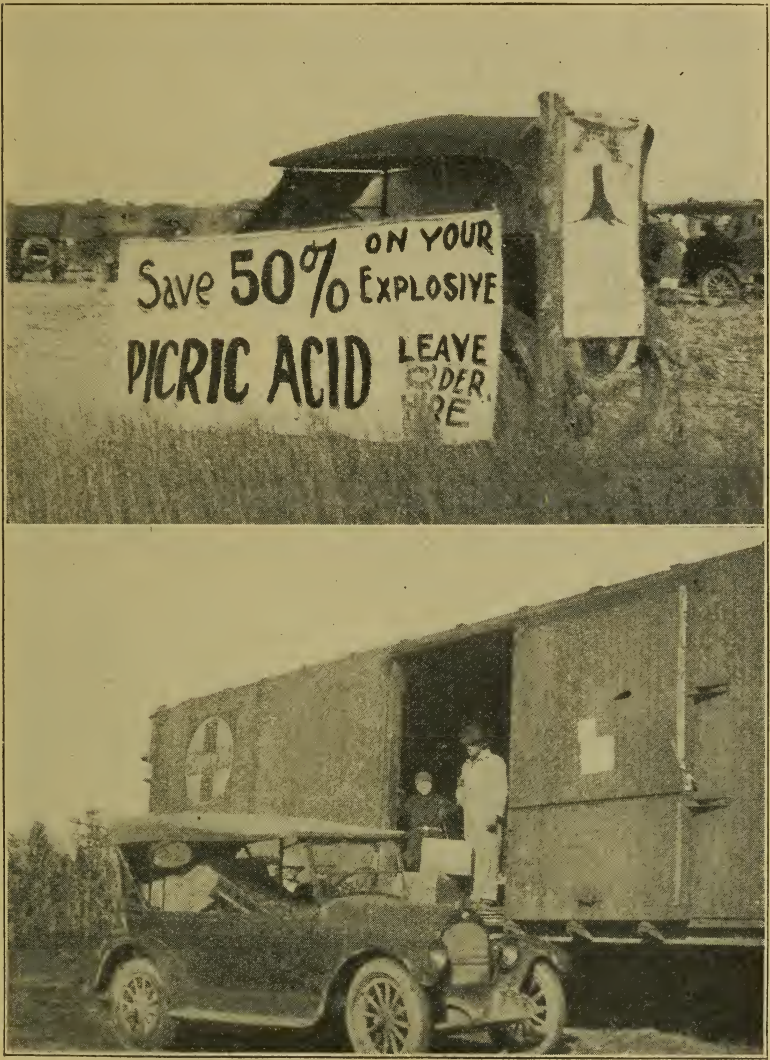

FIG. 17.—GETTING "PICRIC" TO FARMERS.

Picric acid left over from the war has been put to useful purpose in Wisconsin. County agents have assisted in distributing 70 cars of this explosive direct to farmers from the car door.

the farmers aggregating $100,000, was made after 75 car loads of other explosives had been sold for spring clearing by commercial concerns. Picric acid added to the above amount another 70 cars so that a total of 145 cars of explosives, an amount sufficient to clear 150,000 acres, were distributed to the 30,000 farmers residing in the cut-over area. This average amount of 5 acres added to the area of each farm will not mean price depression of farm products of this section because it will be consumed in the locality where it is produced. It will mean a better living—more of the necessities and perhaps some of the comforts of life for farmers living in this part of the state.

Potato Development

Probably no other crop raised in Wisconsin has so many elements of speculation in it. Favorable conditions and a good yield always result in lower prices. The standardization of seed, the grading of the crop, the production of maximum yields on limited areas of ground through good culture and

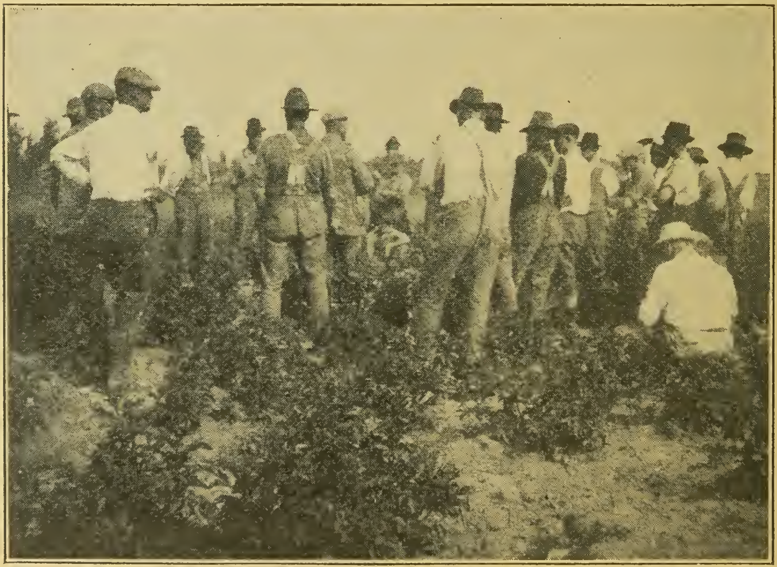

FIG. 18.—POTATO FIELD DEMONSTRATIONS.

Farmers learning the destructive habits of plant diseases on the ground where they occur. Many of these may be controlled by proper methods.

FIG. 19.—ON THE WAY.

Potato growers on their annual tour throughout the potato district visit fields to study good and bad methods in potato culture.

crop rotation seem to be the most certain means to success. The question may well be asked, "Is there not some other crop that can be grown in the potato section at less hazard and with greater assurance of reasonable return?" One thing is certain. Diversified farming is always better in the long run than is the single crop system, yet no section can raise better potatoes than central and northern Wisconsin. Wisdom lies in moderate acreage, wider use of better seed, and larger control of marketing. In the development of the potato seed business, Wisconsin has taken a forward step as a result of the seed certification. Over 400,000 bushels of seed stock are now available from 549 farms. The markets are now recognizing the value of this stock and more and more are demanding it.

Plant Disease Takes Toll

On no crop can the individual farmer expect to make a profit where any large portion of it is destroyed by disease. The crops from which plant diseases take their largest annual toll in this state are fruits, potatoes, and cabbage.

Treatment of seed by corrosive sublimate, the spraying of plants with various mixtures and the use of disease resistant seed are the surest means of checking this loss. The amount thus saved often may suffice to convert a loss into a profit. That farmers are taking advantage of these opportunities to prevent loss is shown by the fact that during the past year over 200,000 bushels of potatoes were treated with corrosive sublimate. The eagerness of the farmer to apply methods that will stop losses is often taken advantage of where no real benefit results. The sulphur treatment for potato scab is a case in point. This method was tried out in six counties during the season just closed. Over a ton of sulphur was used with little resulting benefit. In consequence of these demonstrations, but little sulphur will be sold in Wisconsin for this purpose. Expenditure of money for untested "remedies" is always a destroyer of profits. The state maintains an Experiment Station to test out these "remedies" thus making it unnecessary for the individual farmer to spend his time and money for such purposes. "Slick" salesmen doubtless will always be able, however, to take advantage of the farmer's credulity to their own individual profit, and the farmer's accumulation of wisdom or experience.

Productive Soil the Basis of Profit

A "half crop" is always an unprofitable crop, no matter what the price. Clover and alfalfa seed sown on land where it will not grow is wasted seed. Hours spent in the cultivation of a crop that in the end yields little are so much "labor in vain." Yet these conditions exist all too frequently on Wisconsin farms.

Many of these disappointments can be avoided by the use of one or more of three things:

1. The use of limestone on acid soils for clover and alfalfa.
2. The use of phosphate fertilizers on long cropped soils.
3. The use of potash on sour peat soils.

The increasing use of limestone and the satisfactory results obtained have already been mentioned in another paragraph.

The use of phosphate fertilizers on long cropped soils has shown favorable returns on 34 out of 39 farms on which they were tried during the growing season this year. On five of

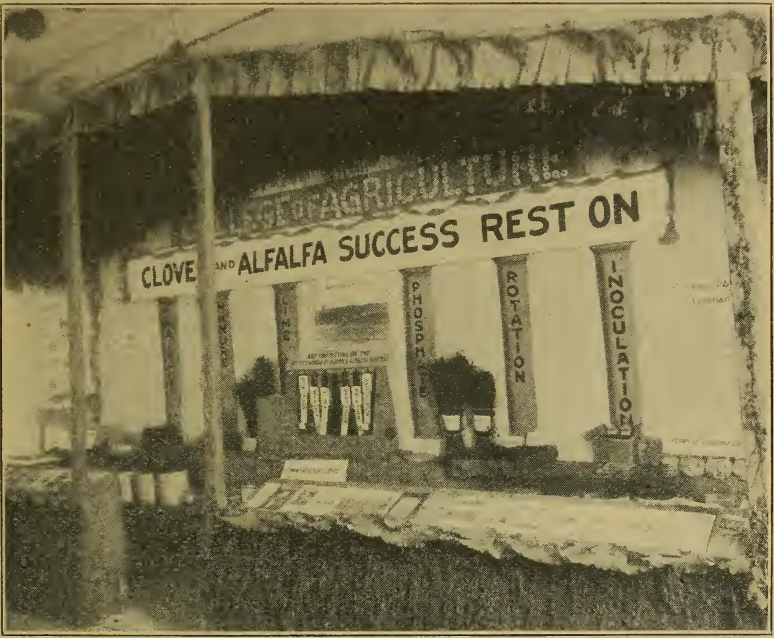

FIG. 20.—A STATE FAIR EXHIBIT.

The six cylinders of success with clover and alfalfa are here shown to be inoculation, rotation, phosphate, lime, manure, and good drainage.

these farms no increase in yield was made. On the remaining farms the returns from the use of phosphate fertilizer (alone or in combination) varied from 2 to 19 bushels of barley—3.5 to 21.3 bushels of oats and from 330 to 1,800 pounds of alfalfa or clover hay where the fertilizer was applied. After making allowance for the cost of fertilizer and its application a favorable crop return is shown to over one-half of the farmers who made these trials. This of course makes no allowance for the unused fertilizer remaining in the soil. If our farms are to show profits throughout a series of years the fertility of the soil must be maintained or increased. This is the one immutable law from which no farmer can escape.

The Profits of Poultry

Poultry as a source of profit is often neglected. Like unprofitable cows, unprofitable hens are a tax on the farmer. Many farmers have learned that after culling out the boarder hens, the remaining flock, on less feed, actually produced the same number of eggs. When this work of sorting and culling has been carried on for years it has been found to increase the production each year over that of the previous year.

On the La Crosse County farm 60 hens were discarded from a flock of 200. These 60 "culls" were put into a separate pen, and during the six weeks that they were held, laid just three eggs—while the remainder of the flock laid 60 eggs a day. Mr. McDowell of Grant County culled his flock, sold the poor ones for $65 and received the same number of eggs from the remainder as from the original flock.

The average production per hen in Wisconsin is 85 eggs a year. The average production of the hens in the flocks that have been "graded up" is 140 eggs each, while the best flocks average 182 per hen each. Wherever selecting and culling has been practiced the production has always been increased, and this increase always tends to make that farmer's flock more profitable.

Orchards Made Profitable

The unproductive orchard cannot be made a source of profit but when properly pruned and sprayed high quality apples

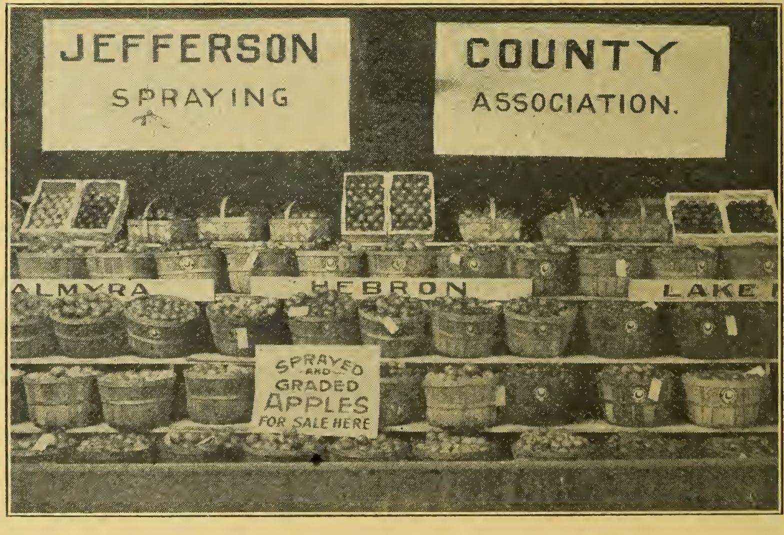

FIG. 21.—COAXING THE BUYER.

Jefferson county farmers pool and grade their apples for market and see to it that they are attractively displayed.

that sell well on the market can be produced. While the income from the farm orchard may not be large—like poultry—it can be made to contribute something to the total income of the farm. The usual objection to orchard improvement is summed up in a typical statement, "If I do spray and get good fruit I can't sell it." The chief difficulty is in disposing of early apples so that cooperative advertising and selling agencies are necessary. How the plan works is illustrated in the case of Jefferson County.

First comes the organization of a cooperative group for the purpose of spraying their fruit trees.

Next comes advertising by placing exhibits in show windows and at fairs in order to familiarize people with the fact that good apples were grown at home. The net result of these efforts was to sell the entire stock at profitable prices.

Making Meat for Less Money

Cheaper production is the farmer's only answer to falling prices. But how is cheaper production possible? It is this question that the agricultural college is trying to answer in its pig feeding demonstrations that have been widely distributed on farmers' own farms over the state. The cost of feed for each hundred pounds of pork made by pigs on pasture has varied from $2.69 a hundred (the lowest), obtained by Mr. Roberts on a lot of 30 pigs at Picketts, Wisconsin, to $5.23 (the highest), obtained on the farm of Paul Langeneggar, Alma, Wisconsin. The average of these fifteen trials with pasture and self feeders on over 400 pigs was a little less than five dollars a hundred. With such feed costs it is evident that even at the present low prices, pork is being produced on some farms at a profit.

Records kept with the sows and litters on four other farms show that feed cost of pigs at weaning times varies from $1.57 each, the lowest figure obtained, to $2.23 the highest, with an average of $1.86 each. When this is compared with the $5 to $6 paid for feeder pigs of equal weight, 30 to 35 pounds each, it is evident that if the care of the sows over winter and at farrowing time does not cost too much, there may be some profit for the farmer who raises his own pigs.

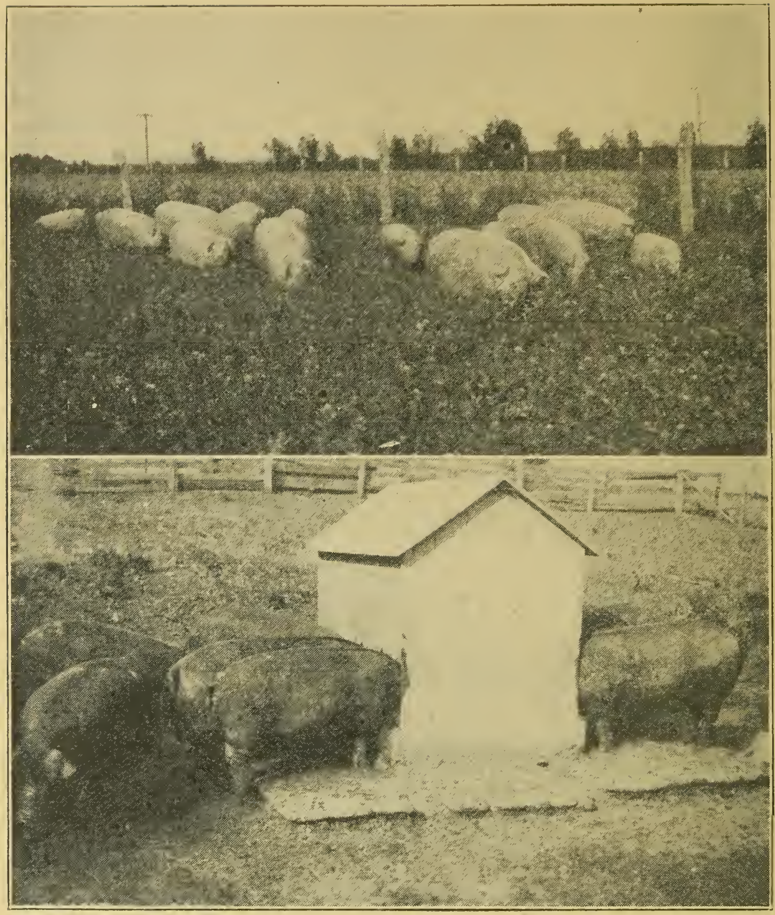

FIG. 22.—HELPING THEMSELVES.

Pasture and self feeders are proving to be the surest means of making profit from pork.

Other Avenues to Profit

There is no business so hazardous as farming. If the farmer successfully runs the gauntlet of drought, flood, frost, disease, and insect pests, he still has to face the market which is then more than likely to be against him. In any event he must stop leaks and fight against losses all along the line.

Diagnosis From Diseased Specimens

As soon as an outbreak of animal disease occurs farmers are usually advised by someone to send specimens to the veterinary department at the College of Agriculture for diagnosis. This service is furnished to both farmers and veterinarians to enable them to reduce livestock losses. During the year, more than 2,500 different specimens were received and examined. Many cases of livestock poisoning through the careless use of insecticides and other poisons have been found.

Hog Cholera Serum Distributed

To check the spread of outbreaks of hog cholera within the state, 300,000 cubic centimeters of serum were distributed to Wisconsin farmers at cost.

Scoring of Dairy Products

To enable the buttermaker to check up on his quality, 418 packages of butter from 216 creameries were examined and scored by the dairy department. Each buttermaker is furnished with a statement that will enable him to improve his quality, and thus secure for his patrons a better market price.

Cultures to Improve Swiss Cheese

Two kinds of bacteria are necessary for the production of high quality Swiss cheese; the "acid forming" and the "eye forming" ones. These are supplied pure to several factories within the Swiss cheese area with the result in one factory that 60 per cent of the output was graded number one or "fancy." In this factory alone the added value of the cheese produced by the use of these cultures was nearly $3,000. It is hoped that an extension of this work undertaken in cooperation with the U. S. Dairy Division, will greatly reduce if not eliminate the severe losses that often occur from "stinker cheese" in the Swiss cheese industry of the state.

Inoculation for Legumes

To insure a stand of legumes, farmers are more and more using inoculation material prepared and furnished by the college. Nearly 50,000 bottles—sufficient to inoculate seed for

50,000 acres—were supplied during the past season, an increase of more than 50 per cent over the previous year. This is widely used especially for alfalfa and soybeans.

Manufacture of Tuberculin

The steadily increasing demand for tuberculin to be used in "cleaning up" Wisconsin herds has made it necessary for the College of Agriculture this year to supply 250,000 doses to the State Department of Agriculture for use in the anti-tuberculosis campaign.

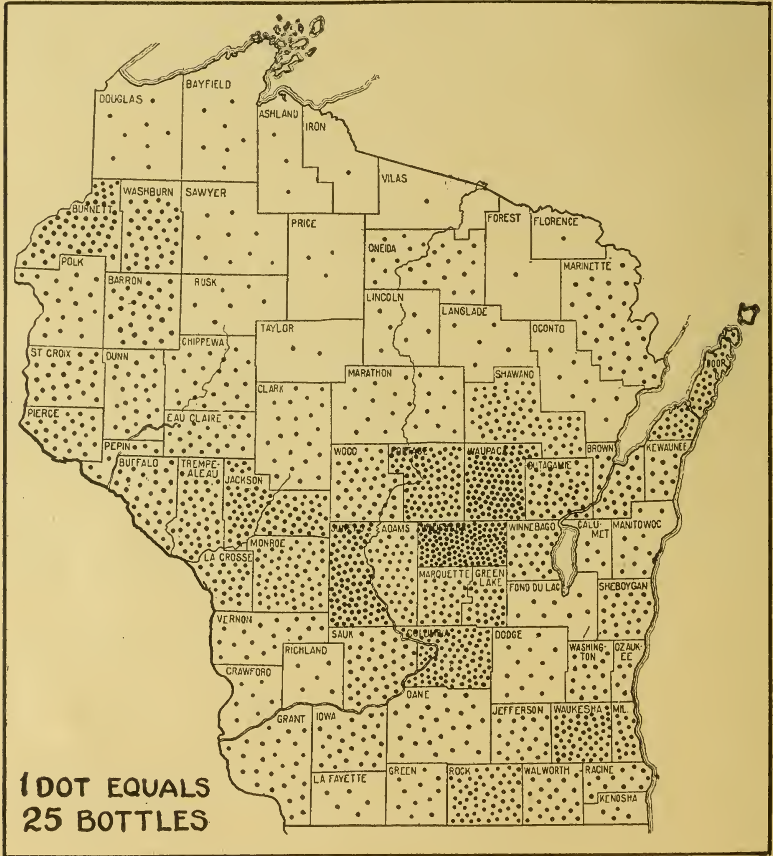

FIG. 23.—DO FARMERS USE INOCULATION?

If there is any doubt of the faith of farmers in the use of cultures for legumes a glance at the above map will settle it. Legume cultures sent to the various counties in Wisconsin from July 1, 1921 to July 1, 1922.

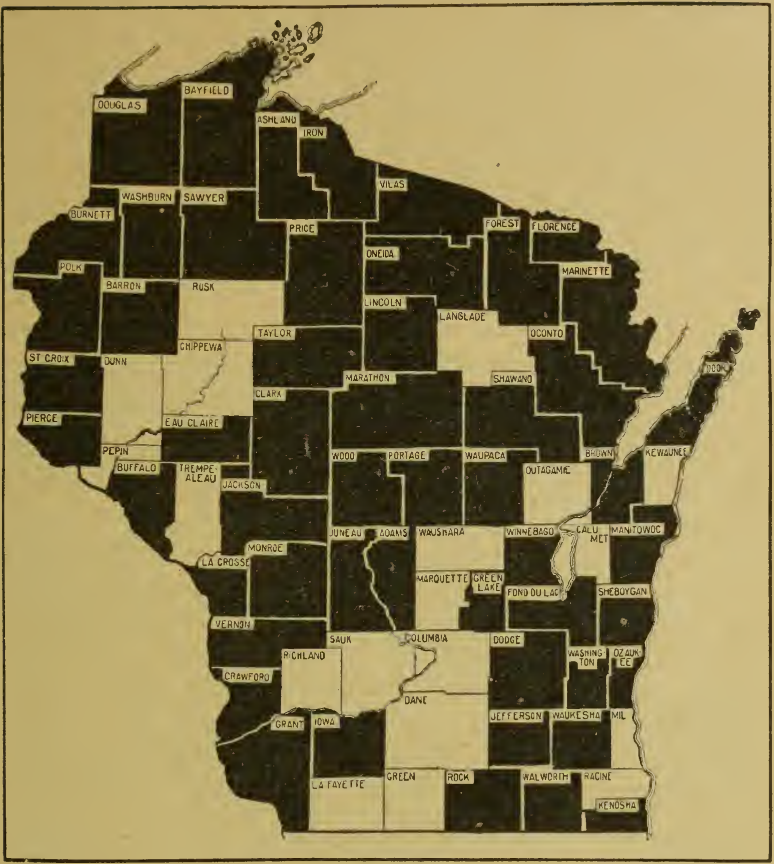

FIG. 24.—COUNTY AGENT COUNTIES.
September, 1922.

Home Grounds Made More Attractive

The highest value of attractive home grounds is not measured in sordid dollars and cents but in the satisfaction, joy, and pleasure derived by those who live in such beauty spots. The natural beauty of the country is unsurpassed. It is only when man lays waste nature's landscape or disfigures it with unsightly buildings that the need for restoring this natural beauty makes itself felt.

Occasionally Nature destroys herself. This she did last spring when she spread a huge mantle of ice over bush and tree. The importance of repairing this damage and restoring to shade trees at least a semblance of their former beauty can be realized only by those familiar with the damage done by the sleet storm of February 22. Tree surgery work done throughout the Fox River Valley and in a belt fifty miles wide extending across the state from La Crosse to Manitowoc did much to repair the damage to shade trees in cities and towns throughout these sections. It is idle to claim that such work materially affects farm profits, but it is easy to see that it does go a long way toward restoring at least a part of the beauty of the landscape lost as a result of the storm in this section.

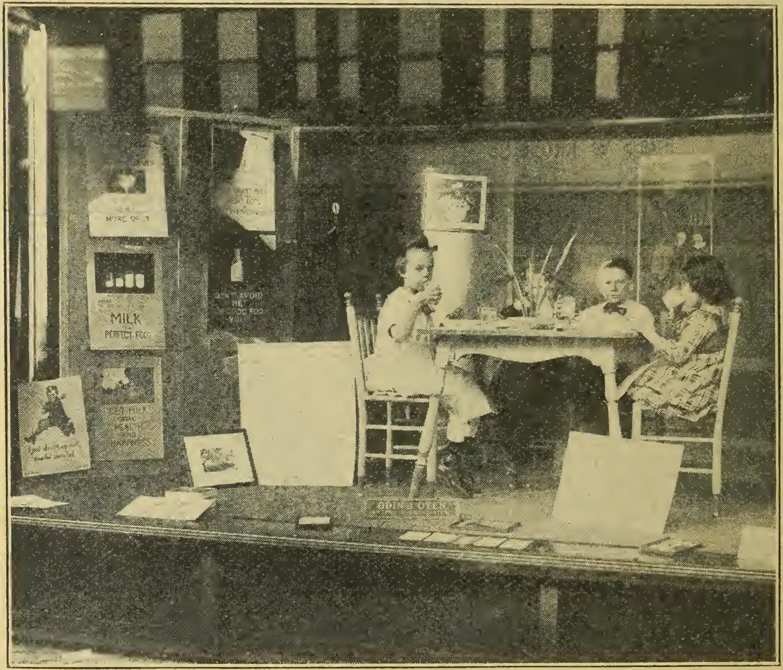

FIG. 25.—AN ATTRACTIVE WINDOW DISPLAY.

Show windows like this prepared by leading merchants help to popularize the use of milk.

Homes Made Better

While it is true that most farm operations can be put on the basis of profit or loss the ideal toward which all farmers are working is one of profit. This is neither possible nor desirable when applied to the home.

Why should farmers labor for profit, if it is not to have better, more comfortable and more beautiful homes? If farm profits do not reflect themselves in better homes then "is our labor in vain and we are yet in our sins."

It is the ideal of "better homes"—more comfortable, more convenient, and more enjoyable—toward which all efforts in home economics extension is directed. Hot lunches introduced into schools increase the efficiency of pupils, promote their health and add to their comfort. Milk campaigns held in four counties did the same thing in increasing the consumption of milk. Yet these are not without economic advantage, since increased demand always stimulates price. Home made dress forms by furnishing women and girls with the basis for trim-fitting, attractive dresses add to the satisfaction of their lives on the farm! Labor savings devices in the kitchen ease their burdens; new and attractive dishes for the table add to the comfort of the family.

Neither is the social life of the country without its possibilities of development. The 34 farm women's clubs organized during the past year are the centers of all these lines of rural

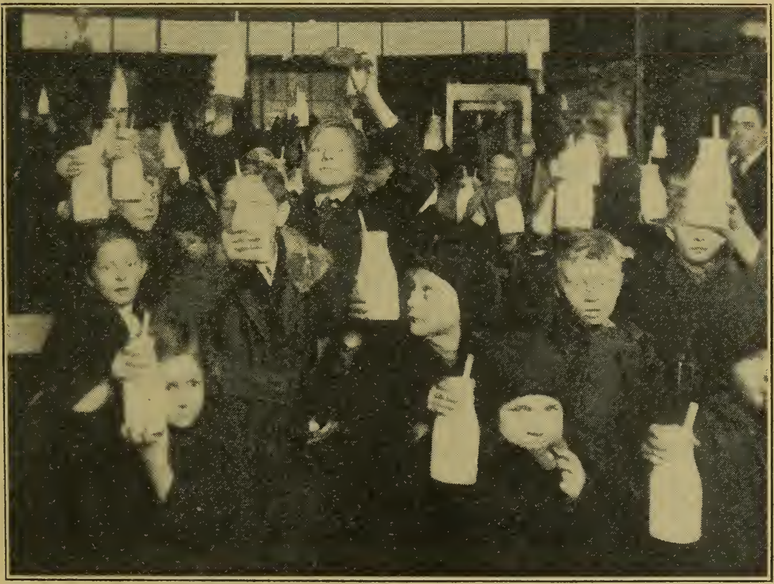

FIG. 26.—SCHOOL CHILDREN DRINKING MILK.

After school children have all taken part in a poster contest, few of them fail to learn that milk is their best food.

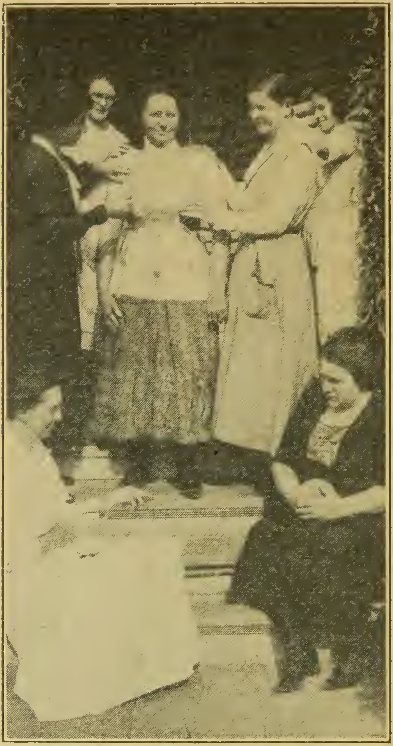

FIG. 27.—WHY THEY FIT.

The paper dress form is easy to make and inexpensive.

home improvement. The past few years have seen changes in the status of women so revolutionary and so potential that we who are living while these changes are taking place will not fully appreciate their social worth. This is particularly true of women who live on farms. In the rural women's clubs lies the largest single opportunity for the improvement of rural conditions and life on the farm. Should we of this age fail to realize this fact or neglect this opportunity future generations will value our efforts in proportion to their true worth and place upon us the responsibility for a decadent country life.

Subject	Department	In Charge	Field Worker
Alfalfa	Agronomy	R. A. Moore	L. F. Graber
Beekeeping	Ec. Entomology	H. F. Wilson	L. P. Whitehead
Boys' and Girls' Clubs	Ext. Service	T. L. Bewick	Mildred Hagerty Wakelin McNeel
County Agents	Ext. Service	J. F. Wojta	W. W. Clark E. L. Luther L. F. Graber G. M. Briggs J. Swenehart
Cow Testing	An. Husbandry	G. C. Humphrey	A. J. Cramer H. C. Searles Erwin Sutton
Dairy Cattle Distribution	An. Husbandry	G. C. Humphrey	A. O. Collentine
Dairy Products Scoring	Dairy Husbandry	E. H. Farrington	J. L. Sammis
Drainage	Agr. Eng.	E. R. Jones	O. R. Zeasman
Farm Accounts	Agr. Economics	B. H. Hibbard	J. S. Donald
Farmers' Institutes	Ext. Service	E. L. Luther	Institute Staff
Field Crops	Agronomy	R. A. Moore	G. M. Briggs H. W. Albertz
Home Economics	Home Ec. Ext.	Mrs. N. K. Jones	Gladys Stillman Gladys Meloche Wealthy Hale Sadie McNulty Lucy Case
Home Grounds Improvement	Horticulture	J. G. Moore	F. A. Aust
Home Orchards	Horticulture	J. G. Moore	F. R. Gifford
Land Clearing	Agr. Eng.	E. R. Jones	J. Swenehart M. E. Jahr H. R. Chipman
Live Stock Improvement	An. Husbandry	G. C. Humphrey	Reid Murray F. Kleinheinz
Meat Production	An. Husbandry	F. B. Morrison	L. H. McKay
Plant Disease Control	Plant Pathology.	L. R. Jones	R. E. Vaughan J. W. Brann
Potato Improvement	Horticulture	J. G. Moore	J. G. Milward
Poultry	Poultry Husbandry	J. G. Halpin	J. B. Hayes D. H. Reid
Soils	Soils Dept.	A. R. Whitson	Grif. Richards H. W. Ullsperger F. L. Musbach

The story of the agricultural extension service has been briefly set down here. The machinery for making it effective is two-fold: (1) the county agents located in nearly all the counties of the state, as shown on the map, and (2) the staff of highly trained specialists, having headquarters at the agricultural college. In order that the reader may know these men and women by name, the list is given on page 35. All should be addressed at the Agricultural College, Madison, Wisconsin.

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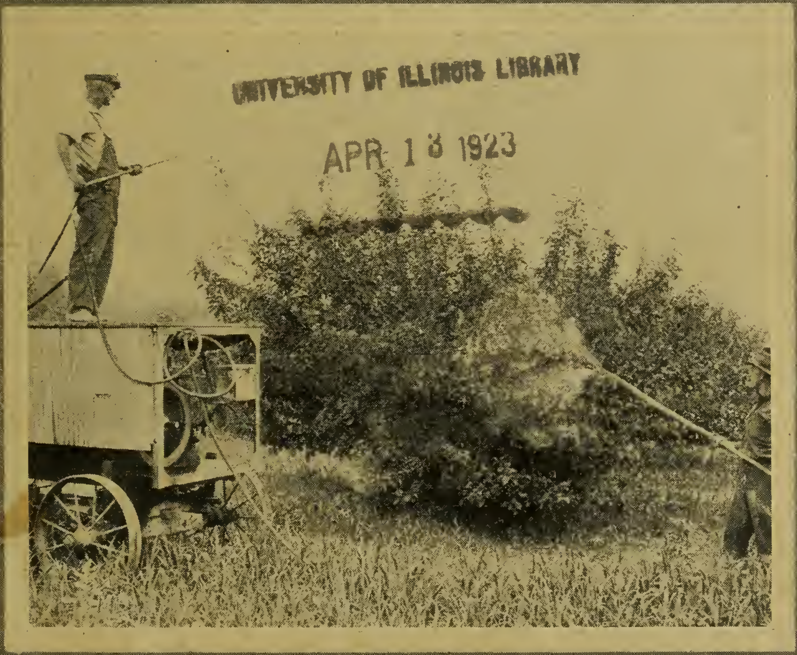
January, 1923

Spray Home Orchards



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EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN
MADISON

The "Spray Ring"

Is organized for more efficient spraying of home orchards. It is made up of a group of farmers having small orchards.

What It Does

Makes possible the owning of a power sprayer at an individual cost less than that of a hand outfit.

Reduces price of spray materials, as they can be secured in large quantities at much better prices than when purchased in small amounts by the individual farmer.

Results in more efficient spraying because of better equipment and better trained operator.

Costs less because the time and material used are reduced.

Results

There is more and better fruit for the home.

The farm orchard becomes an asset instead of a liability.

The farm income may be increased by a surplus of marketable fruit.

Organization

Members are groups of six to twelve farmers whose farms are close together.

They purchase a power machine suitable for their needs, the cost ranging from $200 to $400. Each farmer owns an equal share.

A member of the "ring" acts as operator and is paid for his work. Other officers are named if desired.

Duties of Operator

Operator buys spraying materials.

Sprays orchards of members at the proper time and in the right way.

Distributes cost of spraying among members of the "ring" on the basis of time and materials used in spraying each orchard.

Spray Home Orchards

DEPARTMENTS OF ECONOMIC ENTOMOLOGY, HORTICULTURE AND PLANT PATHOLOGY, CO-OPERATING

EVERY FARMER having an orchard should spray. He should spray thoroughly, at the right time, and with the right materials.

Why Spraying Pays

It is necessary to the production of good fruit in Wisconsin.
It makes possible larger yields.
It keeps the trees healthier.
It is cheap insurance for fruit.

The date of spraying will vary more or less with seasonal conditions, the pests to be controlled, and the varieties of fruit grown. *Never spray fruit trees with poison when many of the blossoms are open.* The more common insect and fungus pests can be controlled under ordinary conditions by the following applications:

Spray Apples for Scale

To control scale insects, spray with lime sulfur shortly before growth starts. Use 5 gallons commercial lime sulfur in 50 gallons of water, which is known as "winter strength lime sulfur". This spray is needed only when the scale becomes fairly numerous. If it is desired to combine this spray with the one following, delay the application until the buds show green.

Control Plant Lice

Spray with 40 per cent "nicotine sulfate" 1 part to 1,000 of water (1 pint to 125 gallons of water), to which should be added 3 or 4 pounds of soap in solution for each 100 gallons. Apply just as the buds begin to show green. This spray will seldom be necessary under Wisconsin conditions.

Annual Sprays Necessary

The above applications may or may not be necessary, but the following applications, known as summer sprays, must be made if the best results in producing pest-free fruit are to be obtained.

Use 1¼ gallons lime sulfur and 1 pound powdered arsenate of lead in 50 gallons of water.

1. "Pink spray." Just before the blossom buds open. (If leaf rollers are numerous use 3 pounds of arsenate of lead).

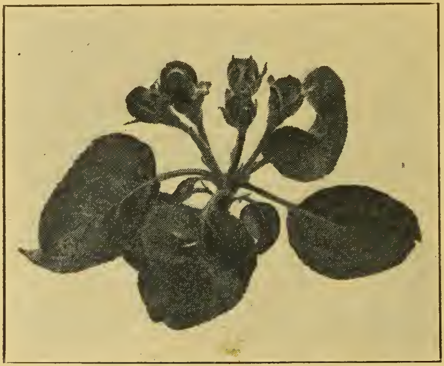

FIG. 1.—PROPER STAGE FOR "PINK" SPRAY.

2. "Calyx spray." As soon as most of the petals have fallen and before the calyx cups close.
3. Ten days after second spray.
4. Three weeks after third spray.

In addition to these four applications two others are frequently of great benefit.

"Pre-pink spray". When leaves of opening buds are about the size of a squirrel's ear. Use regular spray.

"Second brood codling moth and late scab spray". Applied to late varieties eight weeks after fourth spray. Use regular spray.

How Much Spray?

For an apple tree the average amount of spray for one application is as follows:

Age in years	10	12	15	20	25
Gallons of spray	2	2½	3-4	4-5	5-6

Cherries and Plums

Spray when spraying the apples.

Grapes

Use bordeaux mixture within ten days after blossoming and at intervals of two to three weeks if needed.

Currants and Gooseberries

Currant worm. Use 1 pound arsenate of lead to 50 gallons of water whenever "worms" are present. Examine plantation at least once a week from May 15 to September 1 for presence of pest.

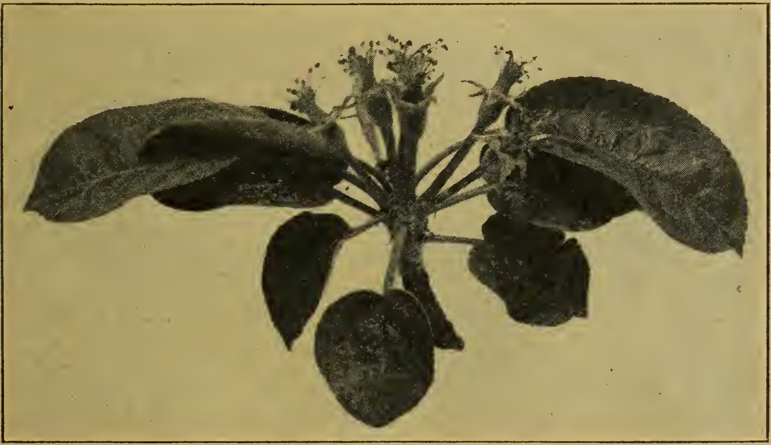

FIG. 2.—READY FOR "CALYX" SPRAY.

Currant lice (aphis). Use 1 pint "nicotine sulfate" to 125 gallons water and 3 pounds of soap in solution just as buds begin to open.

Leaf diseases. Spray when spraying apples.

Raspberries and Blackberries

Anthracnose. Two applications of spray as follows:

1. When first two or three leaves have unfolded on the canes in early spring use lime-sulfur, 1-10. (Winter strength).
2. About one week before blooming period use lime-sulfur, 1-40. (Summer strength).

Crown gall. Use healthy stock and plant in soil where crown gall has not been found.

Cane borers. Prune out and burn the wilted cane tips as soon as observed in June or July. Cut off the wilted tips a few inches below the wilted area.

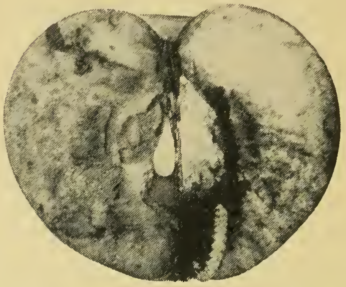

FIG. 3.—CODLING MOTH IN APPLE.

Strawberries

Leaf spot. Cut off the leaves and burn soon after harvest.

Leaf roller. Spray plants with arsenate of lead, 3 pounds to 50 gallons of water, as soon as any rolling of leaves is noticed. Cutting off the leaves and burning soon after harvest also aids in the control.

Root aphis. Use plants known to be free from this insect.

Spray Materials and Formulas

When preparing sprays in small quantities it is very convenient to have a postal scale and a measuring spoon such as is used in the kitchen. It is much more satisfactory to weigh the dry materials. The following formulas give spray materials of approximately the same strength as those used in commercial orchards:

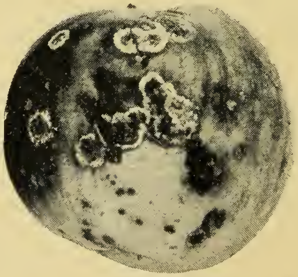

FIG. 4.—APPLE SCAB.

Lime sulfur (liquid) (winter strength) 1 pint to 1 gallon water

Lime sulfur (dry) (winter strength) 4 ounces (8 level tablespoonfuls) to 1 gallon water.

Lime sulfur (liquid) (summer strength) 1 pint to 5 gallons water.

Lime sulfur (dry) (summer strength) 1 ounce (2 level tablespoonfuls) to 1 gallon water.

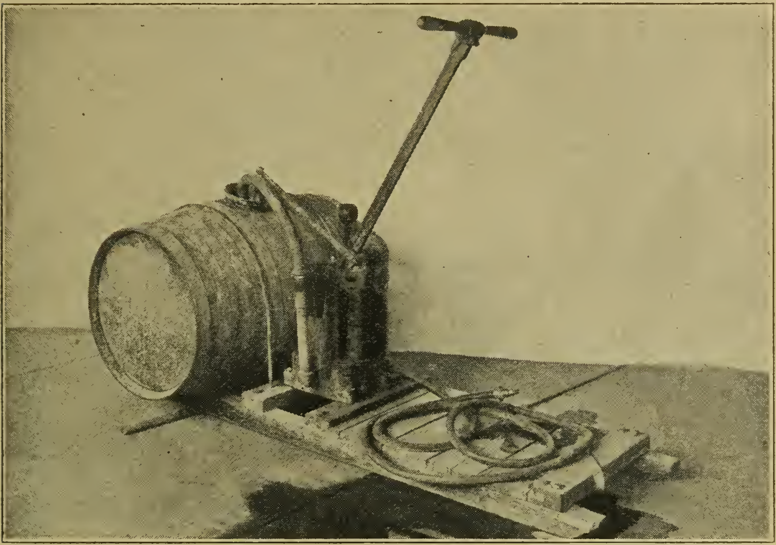

FIG. 5.—A GOOD SPRAYER FOR SMALL ORCHARDS.

Arsenate of lead. To make a spray equivalent to 1 pound to 50 gallons of water, use 1 ounce (6 level tablespoonfuls) to 3 gallons of water.

Bordeaux mixture. For small quantities get ready prepared bordeaux and follow directions on containers.

Published and distributed under the Act of Congress, May 8, 1914, by the Agricultural Extension Service College of Agriculture of the University of Wisconsin, K. L. Hatch, Assistant Director, the United States Department of Agriculture cooperating.

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CIRCULAR 159

MAY, 1923

Control Anthracnose on Black Raspberries

EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN, MADISON

Control Anthracnose on Black Raspberries

L. K. Jones and R. E. Vaughan

BLACK RASPBERRY plantings may be kept practically free from anthracnose, a fungus disease which has caused a decrease of nearly 80 per cent in the acreage devoted to this crop in Wisconsin during the last twelve years. At present there are less than 30 acres of black raspberries in the state.

Anthracnose may be controlled by starting with disease-free plants, by clean cultivation and careful pruning, and by spraying thoroughly before the blossom buds open.

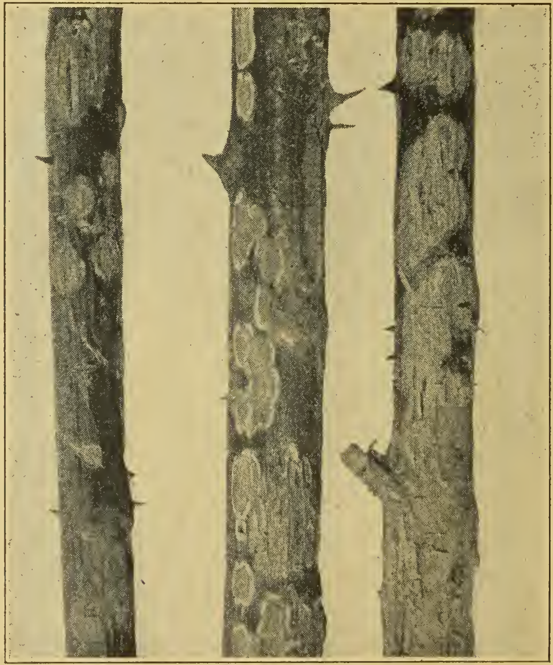

FIG. 1.—ANTHRACNOSE ON BLACK RASPBERRY CANES

The disease usually appears as small reddish spots on the young growing canes and leaves about the middle of May.

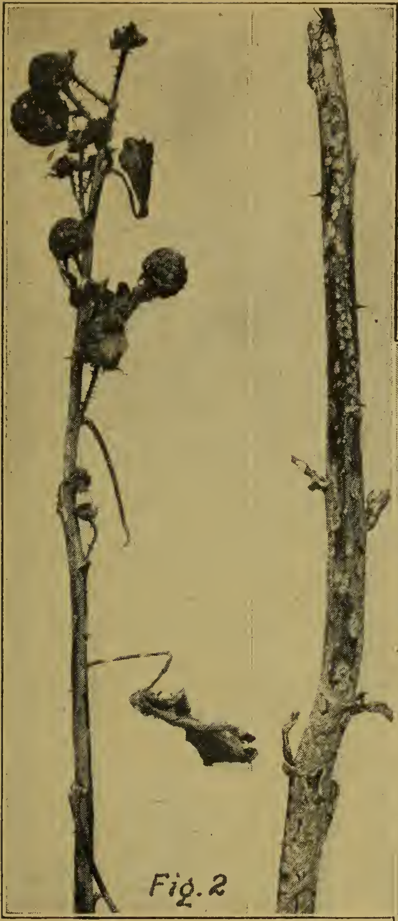

FIG. 2.—FRUITING BRANCH AND CANE FROM UNSPRAYED CUMBERLAND.

When the fruiting branches and canes are infected with anthracnose the fruit becomes dry and tasteless and the next year's crop is reduced.

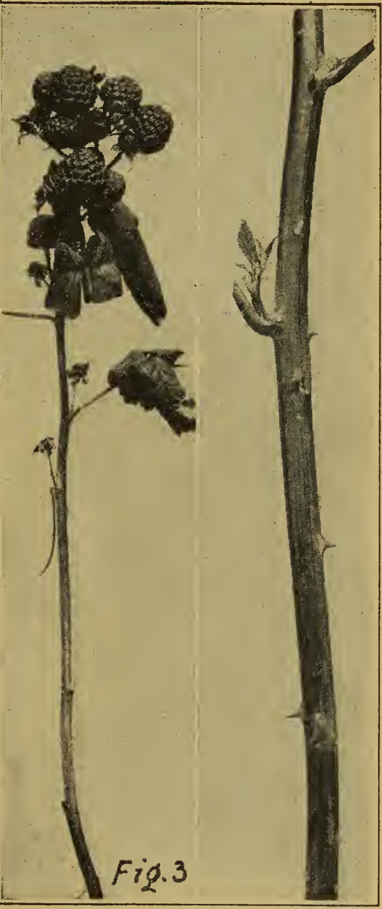

FIG. 3.—FRUITING BRANCH AND CANE FROM SPRAYED CUMBERLAND (Reduced one-half.)

These plants were sprayed twice and the disease controlled. An increase of 30 per cent in fruit yield was obtained from sprayed plants as compared with those unsprayed.

These spots, especially on the canes, enlarge and become grey to white in the center with raised reddish margins. Often the spots are so numerous as to cause large irregular whitish patches on the canes. These patches weaken the canes and shorten the life of the planting. When the disease is abundant the plants are weakened and are more liable to winter injury. The disease often spreads over the surface of the fruiting branches and fruit stems and may cause the fruit to be small or not to ripen. Antracnose lives over winter in the spots on the canes. From small fungus bodies in these spots, spores are shot out into the air in the spring. These spores are carried by the wind and cause the disease to appear on the new plant growth. During the spring and early summer the disease is further spread by another type of spore produced on the spots and washed about by rain.

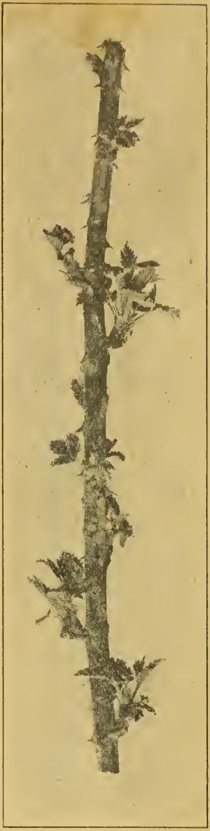

FIG. 4.—APPLY FIRST SPRAY WHEN SPRING FOLIAGE LOOKS LIKE THIS.

Start with disease-free plants. Since the disease may be carried to the new planting on old canes, it is advisable to remove the old canes from layered tips and plant only the roots and crown of the plant. Young plants should be removed from the vicinity of the old plants before the new shoots are four to six inches high.

Cultivate clean and prune carefully. Keep the rows free from weeds and excess growth in order to allow for maximum air drainage about the plants.

Spray thoroughly before the blossom buds open. Spray twice each spring for best control: (1) After two or three leaves have unfolded on the old canes in the spring using liquid lime-sulful, 1 gallon to 9 gallons of water; and (2) about one week before the blossom buds open, using liquid lime-sulfur, 1 gallon to 39 gallons of water. Care should be taken to cover the old canes thoroughly as well as the new growth.

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B

Circular 160 June, 1923

Clothing The Baby

EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN, MADISON

Clothing for the First Year

1. *Straight flannel bands.* These are worn only the first weeks until the cord dressing is off, and are now often omitted, a gauze bandage being used instead.
2. *Knitted bands* with shoulder straps. These should be straight sided and not barrel shape. Two small (Size 1) and two larger ones (Size 2) should be provided.
3. *Shirts, light or medium weight,* part woolen, or cotton in warm climates, with long sleeves and high neck. From two to four are needed.
4. *Diapers of birdseye cotton.* Five dozen is the least number that will allow for washing only every other day. Several different sizes should be made such as 18 by 36 inches, 22 by 44 inches, and 26 by 52 inches, the largest size.
5. *Stockings* of part wool or booties long enough to reach over the knee. For changeable or cold climates at least three pairs should be provided; in warm climates none may be needed.
6. *Slips or dresses* of white washable cotton. Eight or ten slips must be made unless they are to be washed oftener than once a week. Gingham rompers may be used by the end of the first year.
7. *Nightgowns* of cotton flannel. These save the slips but are not necessary for the first six months. Three or four nightgowns should be made for the older infant.
8. *Petticoats* of flannel without sleeves. At least three are needed in cold weather.
9. *Flannel kimona or sack.* One or two are desirable to give slight additional warmth in cold weather.
10. One or more *soft woolen knitted shawls,* one yard square or 1 by 1½ yards. A square of flannel may be substituted.
11. *"Baby Bunting"* or outdoor coat and mittens in cold climates.
12. *Muslin cap* or knitted woolen cap or hood.

Clothing the Baby

Dorothy Reed Mendenhall, M. D.

THE COMFORT and welfare of the baby should be the mother's first thought in planning clothes for her child. She should also choose materials that are suitable and economical and make the clothes so that the sewing and laundering are done with the greatest ease.

What Does the Baby Need?

Except in very hot weather every infant needs at least a knitted part-woolen abdominal band, a diaper, and a cotton slip or dress for house wear.

To these should be added as the indoor temperature demands, a cotton or part-woolen long sleeved shirt, and a flannel sack or sweater. In very warm weather all the clothing except the band and diaper may be removed but care must be taken to put on more clothes as soon as the temperature moderates. Outdoor garments should suit the climate and the season.

What the Baby Needs

Suitable Outdoor Clothing

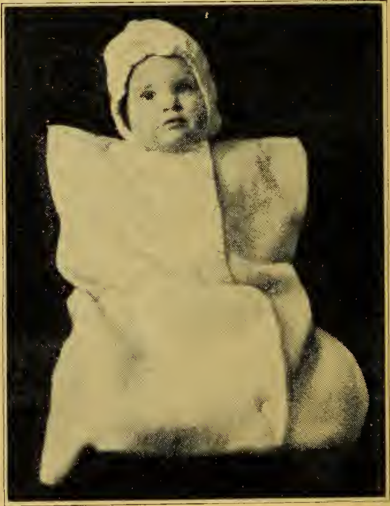
In warm weather a baby may need no extra clothing for outdoors. A soft knitted shawl or a flannel kimona wrapper and muslin cap may be used in mild weather. In cold weather a warm outdoor wrap is needed, such as a "Baby Bunting" of wool blanketing or eiderdown which covers the baby's arms and provides a hood for the head. The baby should, if possible, take his nap or a daily airing outdoors even in cold climates but he needs to be well protected. A sweater, woolen cap and mittens may be added in cold weather for outdoors or for night use in very severe climates. A properly clothed baby has warm hands and feet but does not perspire.

The Flannel Shirt Is Comfortable

Quiet Sleep Depends Largely on Suitable Night Clothes

It is most unhealthful for anyone to sleep in the clothing worn in the daytime. A young infant at night should wear the same number of garments worn in the daytime but the day clothes should be taken off at bed time and a fresh set put on at night. A good sleep is promoted if the baby is allowed to kick freely and is given a good rubbing at the time of this undressing. A night gown may be used instead of a slip. A knitted shawl may be wrapped around the baby, and, if additional covering is needed, another shawl or crib blanket is placed over him.

A sleeping bag of woolen blanketing is almost a necessity in cold climates for outdoor and night use. Lighter bags of flannel or cotton flannel are useful in moderately cool weather. A sleeping bag allows a child complete freedom of motion but prevents his becoming uncovered and chilled, for when he moves he takes his coverings with him. A diaper or "panties" of thin washable rubberized cloth will keep a child dry at night and, as a rule, does not irritate the skin if not worn continuously.



"Baby Bunting" Prevents Cold Hands and Feet

Choosing Foot Covering

Except in unusually warm weather it is better for a baby to wear stockings or long booties in a climate like Wisconsin. Socks should not be worn except on very warm days, warm enough to go without any foot covering.

One-Piece "Gertrude" for Day Time Wear

When a baby begins to creep he may be put in leather moccasins or home-made felt shoes to protect his stockings. The run-about should wear leather moccasins or soft soled ankle-ties. When the baby begins to walk outdoors either button or laced shoes with firm but flexible soles are needed. A child's shoes should be long and wide enough for the foot with straight sided lasts so that the big toe will not be flexed or turned in. A short stocking may be equally harmful. A shoe that is too large may do as much harm as a short shoe for the foot tends to slip down into the toe.

A baby's hands and feet have to be kept warm or his digestion will suffer.

small children.

All wet diapers should be washed in hot water and rinsed before using again. Soiled diapers must be rubbed in soap suds, using a good mild white soap, boiled and thoroughly rinsed before using again. Diapers should be dried outdoors if possible. They need no ironing. If washed only two or three times a week, diapers should be thoroughly rinsed and kept in a covered enamelware pail.

All woolens should be washed by the cold process to prevent their becoming yellow and stiff.

Washing the Baby's Clothes

Fresh sets of day and night underwear should be put on at least once a week. Other clothing should be changed when soiled or mussed. No starched clothes should be used for

Cold Process for Washing Wool

Add 1 cake of shaved mild soap to 1 quart of soft water. Heat until dissolved. Pour it into a 2-quart jar and fill up the jar with cold soft water. For small pieces of flannel, lace, and childrens' fine dresses, use 1 heaping tablespoonful of this jelly and 1 tablespoon of borax to a basin of cold rain water. Dissolve the borax in hot rain water until no lumps remain before adding it to the soap solution. Fill the basin with cold rain water and put in materials to be washed. Let them stand overnight. At some convenient time rinse them twice in cold soft water. Wring them out and dry in the open air.

Selection of Clothing

In planning children's clothing it is important to remember that clothing is worn primarily for warmth for it prevents loss of heat from the surface of the body. The smaller and thinner the child, the greater is the heat loss relative to his size and the more care must be taken to keep him properly covered.

Only washable fabrics should be used for a baby. White is, in general, preferable to colored material as it washes better. Pink wool holds its color better than blue on the whole, but blue cotton lasts better than pink. Dress fabrics should be chosen for durability and ease of laundering as well as for fineness. Fine long cloth, nainsook, or cross-bar dimity make attractive slips. Cotton crepe or seersucker, however, require little or no ironing. Woolen material should contain from one-fourth to one-half cotton or silk, for material made of all wool will shrink and become non-porous, like felt. Loosely woven fabrics are more porous and allow of evaporation of moisture from the body. Cotton flannel is not a substitute for wool and should not be used for underclothing or for outer garments designed for warmth. Birdseye cotton makes the best diapers for they are easier to keep clean and white than cotton flannel or knit goods.

Making Clothing

All clothing should allow free movement of the baby's arms and legs which is nature's method of exercise. A child should not be pinned down or confined long in one position. Nightgowns with a drawstring in the bottom are objectionable as they hamper motion.

Straight bands are made by tearing three-quarters of a yard of flannel into strips 6 inches wide. They are not hemmed. Shirts may be very satisfactorily made from pieces of underwear.

Diapers should be cut twice as long as wide and 4 inches should be allowed for shrinkage and hem. A tape sewed on the tab of the band through which the diaper pin is slipped will save the band from wearing.

The first slips or dresses, nightgowns, and wrappers should be made kimona style as they are easier to launder than when sleeves are set in. Slips or dresses should be made with draw strings or beading and ribbon in neck and end of sleeves, so as to be adjustable to the size of the child. If preferred, small ribbon covered elastic may be used to hold the sleeves up on the arm. No buttons are needed. The length of the slip should be from 20 to 22 inches from the neck to the bottom of hem. It is best to cut the neck 10 inches and the end of the sleeves 7 inches wide. By making the slip wide in the shoulders, long in the arm, and adjustable at neck and wrist, they may be used until worn out. A fold may be run in by hand over the shoulder to fit them to the tiny baby. There is no necessity for making a first and second set of clothing for the first year.

A Simple Dress for the Baby

Flannel skirts should be made one piece or "Gertrude" fashion and fasten on the shoulder or opened straight down the front or back and fasten with tapes, small flat buttons or snaps. Flannel petticoats for the two-year-old may be made with cotton body and are usually fastened in the back with buttons. The edges of flannel should not be hemmed but should be finished with scallops in button-hole stitch or rolled and finished with a blanket stitch. A flannel hem does not wash or iron well. The flannel skirt should be 1 or 2 inches shorter than the slip. This length will cover the feet of a young baby and be about walking length at one year. Nightgowns also should be made kimona style but longer, about 30 inches.

Slips and nightgowns may be made to open either all the way down the back or the front, if desired. The back opening keeps the outer clothing clean and dry longer but can be used only the early months before the baby moves about.

The front openings of the petticoat and slip, or nightgown, enable the mother to dress the baby more easily and quickly than any other way. By spreading out the dress or night-

Short Skirt Worn by Older Baby

gown and placing on it the open flannel petticoat and the shirt, then slipping the sleeves of the shirt through the arm holes of the petticoat, and dress or night gown, these three garments may be put on at the same time. The baby in band and diaper is laid on his back on top of these open garments. First one arm and then the other is inserted in the sleeves and one garment after the other is quickly fastened down the front.

Front or back openings do away with turning over the baby or putting garments on over the head or feet. This makes the dressing easier for both mother and child. After a child walks, the clothing may be closed either in front, in back, or on the shoulders, since the child can sit or stand to be dressed. Buttoning in front, however, enables a child to dress himself earlier.

The baby's clothes are in better taste and are easier to wash and iron if they are simple. Good material needs no adornment. Frills, wide lace, and embroidery are out of place, and only encumber the infant. If the mother wishes some trimmings, hand needlework is the most suitable. The neck and sleeves must have no harsh or starched edging to irritate the delicate skin of the infant.

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Circular 161 June, 1923

MERCHANDISING FARM PRODUCTS

EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN, MADISON

THE GREAT NEED of the day is for constructive understanding of the possibilities, responsibilities, and secrets of success of efficient cooperative merchandising companies. It is through the helpful assistance of the managements of these companies alone that information of this kind can be obtained. This circular was made possible by the hearty cooperation of the following organizations:

California Fruit Growers' Exchange
Consolidated Realty Bldg
Los Angeles, California

The California Prune & Apricot Growers' Assn.
San Jose, California

The California Peach & Fig Growers
Fresno, California

The American Cranberry Exchange
90 West Broadway
New York City

The Hood River Apple Growers' Assn.
Hood River, Oregon

Sun-Maid Raisin Growers
Fresno, California

The California Walnut Growers' Association
1745 East Seventh Street,
Los Angeles, California

The Florida Citrus Exchg.
Tampa, Florida

The Tillamook County Creamery Association
Tillamook, Oregon

The Okanagan United Growers,
Vernon, British Columbia

The Fraser Valley Milk Producers' Assn.

703 Rogers Bldg.,
Vancouver, British Col.

Merchandising Farm Products

THEODORE MACKLIN

THE FARMER, the consumer, and the middleman are all buying or selling services or products. They realize that selling is disposing of what they have for the price which is offered. Selling is merely this exchange of something for money. It may be very unsatisfactory and frequently is. This is what farmers complain about so vigorously and continually.

Marketing is much more than simply selling. It is the rendering of all those necessary services between the farmer and consumer which make it possible for consumers to use the products of farms. Marketing includes such services as assembling, grading and standardizing, packaging, processing, transporting, storing, financing, distributing, risk spreading and selling.

Merchandising Is Marketing to Advantage

Merchandising is a program that insures up-to-date modern methods throughout the marketing system all the way from determining the character of production and standardization of the product to delivery to consumers of what will please them. It means that the various services in marketing shall be rendered in an efficient and economical manner to the best advantage of those using the system.

The demand for improved marketing is widespread and insistent. It comes from farmers and consumers everywhere. Marketing must and will be improved. The question is, who will bring the improvement into reality?

Private Marketing Is Weak

There are two important mediums by which marketing may be bettered. Today most of the work of marketing is done by one of these mediums only—the private marketing system composed of numerous disconnected, unrelated corporations and business units. The work of this system is for the most part not coördinated. The system operates upon the individual estimates of managers who have but a small part of the needed information and confidence to render service at greatest efficiency for minimum shares of the consumers' dollar.

One of the great weaknesses of the system is the practice of buying raw materials from farmers on a flat price basis regardless of different grades or qualities. This practice breaks the influence of consumer prices and desires upon production and hence stimulates undue production of the very commodities for which consumers have the least real demand. This more than any other single cause works hardships upon both farmers and consumers.

Cooperative Marketing Limited

The second medium of rendering marketing service is the cooperative marketing organization. At the present time only a small part of the farm products of the country are marketed through this medium. A period of thirty years of widespread experiment and experience with this agency, however, has demonstrated that it can render better service for less money than the older private system has been demanding.

Must Choose More Efficient Agency

The day of choosing between these systems is drawing closer. The dissatisfaction with the private marketing agency is leading steadily toward the formation of increasing numbers of cooperative agencies. All of this is witnessing the fact that the middleman as a private operator is standing dormant while the middleman as a cooperative operator is becoming active. The choice as to which of these two contestants to patronize will hinge entirely upon which is the more efficient and actually renders the better service to the public for the smaller proportion of the consumers' dollar.

The point of view of the two agencies themselves will undoubtedly determine which is to win in the race for business. The conditions of winning favor from farmers and consumers are the same for both. Whichever meets these conditions most successfully will survive in the competitive struggle. While private marketing companies do the bulk of the business at present there is no justification for their continued popularity unless they render the kind of service to farmers and consumers which they demand. Similarly there can be little justification of a cooperative marketing company which does not win its laurels by outdoing the service and efficiency of its private competitors.

Public Chooses Agency That Satisfies

The public is a hard and critical judge. It awards its prizes according to performance, though the contestants may spar for time and sentimental advantage where economic ability is lacking. When the racing promises to be close in a contest the well filled grand stand is evidence of public approval. When contestants, on the other hand, are unable to please, gate receipts run low either until old contestants have learned new means of being attractive or until new competitors have come on to the scene.

In marketing the time has come when private middlemen in the role of the old contestants must either adopt modern scientific methods in marketing or else cooperative agencies will occupy the field because of their open point of view and eager desire to render service of an unexcelled character.

Merchandising Essentials Are the Same

The secrets of efficiency in rendering satisfying service in marketing are alike for both private agencies and cooperative agencies. Each is but one way of organizing to insure to the public the performance of necessary marketing work. One may expect to win over the other by the extent to which it can obtain better products and with them win the public confidence. In other words the one which is able first to develop a well rounded merchandising program and operate it with minimum charges between farmer and consumer stands the best chance of winning in the race for survival.

Must Win Satisfied Consumers

"Two consumers where one grew before" is the slogan of a new day. It challenges producer, consumer and middleman to a change of both mind and heart. The overproduction bugaboo which the farmer hopelessly hopes to overcome by compulsory underproduction is a negative, a destructive, an unworkable remedy for agricultural ills. What is needed is constructive effort.

Commodity Merchandisers Well Known

Fortunately in various parts of the world, including the Pacific Coast, Florida, and parts of the East and Central West, experiments in merchandising have been undertaken long enough to be now developed beyond the experimental stage. The experience in merchandising by the commodity organizations responsible for the names "Eatmor," "Sealdsweet," "Sun Maid," "Sunkist," "Sunsweet," "Tillamook," "Hood River," "Diamond Brand," "Blue Ribbon," "O. K.," and others has proved that merchandising when properly developed vastly improves marketing conditions. These successful organizations which handle products varying from cheese to cranberries, point the way to improved and modern methods for the handling of many kinds of farm products.

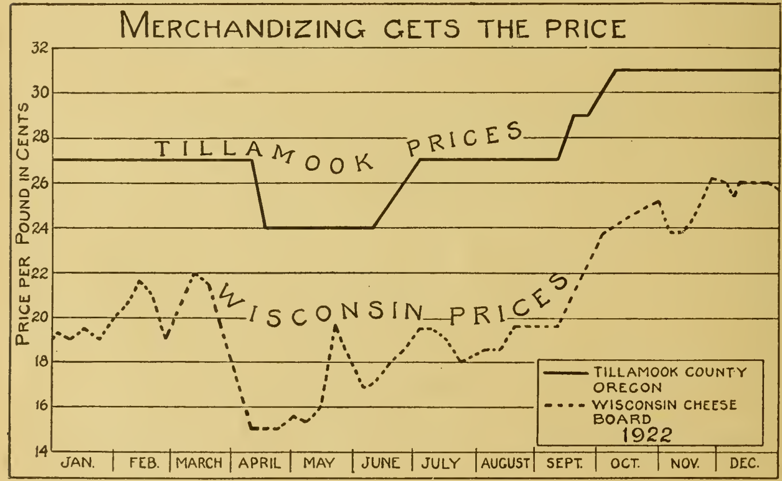

FIG. 1.—TILLAMOOK ORGANIZATION STABILIZES PRICE

While cheese marketed by the Tillamook County (Oregon) Creamery Association sells in competition with that from Wisconsin, it is interesting to know that merchandising essentials efficiently applied enabled Tillamook farmers to obtain stabilized prices that averaged more than 30 per cent higher than Wisconsin prices during the year 1922.

Merchandising Includes Selling to Advantage

What are these organizations doing for farmers? They are merchandising farm products. But what is merchandising? Upon what does effective merchandising depend? Merchandising for these enterprises is vastly more than mere selling. It is constructive effort to get two satisfied consumers where one indifferent customer existed before. Instead of first producing and then wondering what the output would bring, the farmers of these commodity merchandising organizations find and win loyalty from a constantly increasing group of consumers at the same time that their increasing output is calling for expanding markets.

Commodity Organizations Serve Industry

The American Cranberry Exchange, of "Eatmor" cranberry fame, handles 66 per cent of the entire cranberry crop. The Florida Citrus Exchange handles a large part of the Florida citrus crop under the "Sealdsweet" trademark. The Sun Maid Raisin Growers' Organization markets 93 per cent of the raisins of the country amounting to more than $35,000,000 of sales. The California Fruit Growers' Exchange with more than $48,000,000 worth of sales for the year 1921-22 merchandised 72 per cent of the California citrus crop. The California Prune and Apricot Growers' Association, by rendering the service that has made "Sunsweet Prunes" a dignified article the country over, is now merchandising 82 per cent of the California prune crop and 75 per cent of the apricot crop with a combined value last year of over $16,000,000. The California Peach and Fig Growers market about 80 per cent of the dried peach and fig crops of the state, valued at over $6,000,000 per year. From a coastal valley of Oregon, some 60 miles long and from 5 to 15 miles wide producing less than 2 per cent of the nation's output of cheese, the Tillamook County Creamery Association merchandised more than $1,500,000 worth of this commodity during 1922. It has made its "Tillamook" brand so famous that its seven million pounds of cheese brings an average premium of over six cents a pound above Wisconsin cheese prices. The Hood River Apple Growers' Association developed a sufficient tonnage of high quality apples to merchandise $2,000,000 worth of them under the famous "Hood River" trademark. The California Walnut Growers' Association markets 80 per cent of California walnut crop. Its merchandising program centering on its "Diamond Brand" enabled it to move over $8,000,000 worth of walnuts last year. The Okanagan United Growers of British Columbia have developed a system that marketed almost $1,700,000 worth of apples last year.

The Fraser Valley Dairies, a subsidiary of the Fraser Valley Milk Producers Association, by handling the bulk of the milk of the region, merchandised over $1,600,000 worth of this commodity to consumers.

It is from these eleven practical commodity organizations supplied with more than $130,000,000 worth of products, and operated by the best talent that can be employed that we have much to learn about how selling can be done to better advantage.

In all these sales organizations the keystones of successful merchandising are observed.

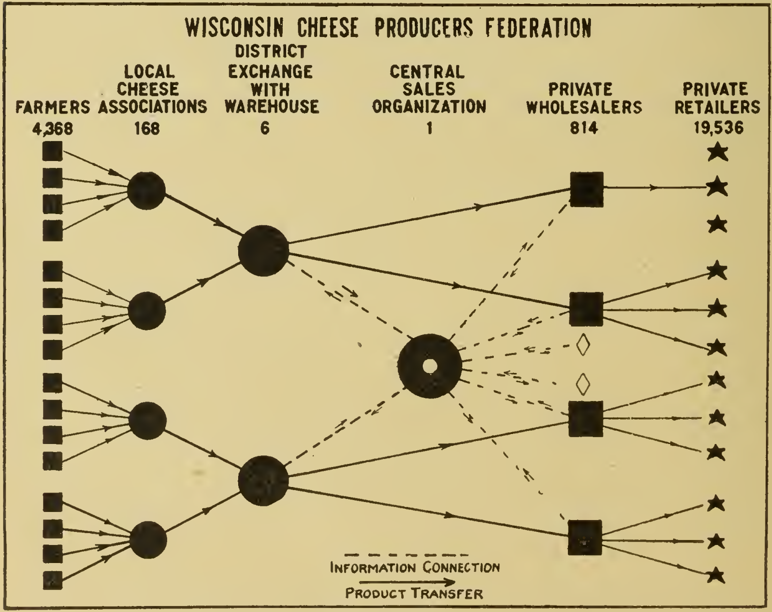
WISCONSIN CHEESE PRODUCERS FEDERATION
FARMERS 4,368
LOCAL CHEESE ASSOCIATIONS 168
DISTRICT EXCHANGE WITH WAREHOUSE 6
CENTRAL SALES ORGANIZATION 1
PRIVATE WHOLESALERS 814
PRIVATE RETAILERS 19,536
INFORMATION CONNECTION
PRODUCT TRANSFER

FIG. 2.—ONE FORM OF COMMODITY MARKETING ORGANIZATION

In organizing commodity companies, there are two main forms, the federated type, illustrated above and the centralized type which omits only the local and district operating associations.

Keystones of Merchandising Success

A commodity marketing company to render necessary marketing services. It must be so created and operated that it renders unexcelled service with the greatest efficiency.

An adequate volume of business is essential to permit and insure minimum per unit cost of operation.

Standardized products must be produced for this company and must be absolutely dependable in quality and pack.

This standardized product must be attractively named and advertised. This means that it must be made known to enough consumers to win "two satisfied buyers where only one indifferent purchaser existed before."

The full and hearty backing and cooperation of the necessary distributing trade, such as brokers, wholesalers, and retailers, must be won and maintained.

Constant distribution of this standardized product must be so timed and placed as to let every consumer that desires to buy be able to obtain the goods when wanted.

The farmer who makes the highly demanded product must receive a better price. In other words, the farmer must be enabled to get what his product sells for to the consumer, less only the necessary merchandising margin or costs.

Commodity Marketing Company Essential

Marketing has been carried on for many years. It is done by institutions of great or small size. It is noteworthy that most of the farmers as well as the consumers are greatly dissatisfied with the results of the existing marketing machines. In all of the places where marketing has been constructively improved, commodity marketing companies have first been organized. Through these commodity organizations the actual work of marketing has been scientifically improved to obtain for the farmer the greatest possible proportion of what the consumer pays.

What Commodity Marketing Is

In using the term "Commodity Marketing Company" there is widespread confusion almost everywhere. To quote the statement of a manager of one of the most successful of the commodity organizations, "the reader must clearly grasp the idea that most successful cooperative associations are formed around one, or at most two, closely allied commodities, and that it is most essential that a cooperative sales organization specialize on one, or at most two, closely allied products."

The marketing organization that handles large quantities each of numerous different farm products is in no sense a commodity enterprise. Such concerns are "variety marketing organizations." While there are a few companies of this kind in operation their success has been slight and their future remains a matter of doubtful outcome. Success in these complicated "variety marketing companies" depends upon many times the normal amount of educational work among farmers and upon unusual need for the operation of a new and improved distributing system.

Commodity marketing organization definitely means that virtually a single raw material or a single finished article is being handled exclusively. Of course there may be slight deviations so that a few other commodities are tacked on as it were, but these only complicate and confuse the business and the membership. Where a variety of products are in evidence, commodity marketing strictly would require as many separate companies as there are distinct products each necessitating handling in a separate and characteristic way.

Middlemen Not Abolished

In none of the examples of successful commodity marketing have middlemen been abolished. Middlemen have simply been induced to bring into existence well planned programs that provide vastly better and more efficient service than was rendered before. Middlemen have been induced or employed to work for the great common interest of the industry of agriculture. The vision that constructive minded men have had where marketing conditions and results have been improved has been to build a better marketing system by using only those who were really expert middlemen.

Marketing improvement depends wholly upon a constructive program. The aim of expediently centralized and well directed sales effort is to reduce wastes in competition and to establish more stable values. In this work the efficient commodity sales systems have been remarkably successful. Their success has been achieved by the use of talented middlemen or marketing specialists. To abolish all middlemen, on the contrary, would be like abolishing all hired labor of any other kind. Yet no sane farmer or consumer is trying to abolish good labor. The problem is partly one of getting enough worth while labor and partly of getting rid of worthless labor.

Just so in marketing. What is needed is the best possible marketing service. Such service could be supplied either by existing systems or if they choose not to render it, by forming new systems. Where farmers of a given product have wanted this better service for many years and have patiently waited in vain for it, they have simply become convinced that the only way to get it was to heed a new call and accordingly where they as farmers have diligently stuck to the building program they have prospered. In many other regions where farmers have wanted and expected results over night by finding success instead of making it, they have met with disastrous failure. Success did not come until a marketing machine was in operation that was responsive to rendering service from the farmers' point of view. An efficient commodity merchandising company is the first great and absolutely necessary step to take if farmers want increased purchasing power through marketing activities.

Adequate Volume of Business Essential

There is only one reason for having a commodity marketing company and that is actually to do business for farmers better than this work can be done in any other way. But farmers and every one else must recognize that all ripe fruit must pass through a green stage. No commodity company can materialize over night and deliver on its second day perfect results, nor even satisfactory results. In other words, there is a growing stage for anything worth while. Those who want to see commodity marketing succeed must not only be willing to wait a reasonable length of time for results but they must feed the organization from the time it begins to grow until maturity.

Feeding a marketing enterprise through the growing stage means to do business with it until by experience and by enlargement it can render better service than any of its competitors. No big stick ever won a satisfied buyer, but unexcelled service has always been rewarded by the premium. It is unrivalled service, giving unmatched satisfaction, that draws to a marketing company two buyers where only one came before.

How much attraction is there likely to be toward a marketing company that has little product to handle and therefore no unexcelled service to render? Growth by a marketing company is impossible without products to handle. Real service that beats all competitors is impossible in the absence of unrivalled products and management.

It is to make possible better marketing service for better products that the farmers have caught that true spirit of better marketing that causes them to market all of their product through their own company. And who would patronize a company which its owners would not themselves patronize? If a commodity marketing company is not patronized one hundred per cent by its own founders, what reason can be advanced for its further growth? These are questions which every farmer must answer understandingly if he wants to see marketing improved. These questions must be answered whether the organization uses contracts or not, for in the absence of this understanding by the majority of the farmers in the community, no contract is binding nor enforceable and no organization can continue to survive.

Management Determines Success or Failure

The most important single point to be emphasized in connection with the operation and success of any commodity marketing company is its management. In the rush and enthusiasm for advertising people are losing sight of this fact. Management is the main problem; advertising is but a single detail in a program of work. To quote an experienced commodity organization leader, "A cooperative sales organization is only as good as its general management. In other words, if the management and policy of a concern is not right, no amount of advertising will make the concern successful. On the other hand, if the sales policy and management is tiptop, the concern might be successful without a nickle's worth of advertising. The first essential of success for a cooperative sales organization is first-class management."

The character of the whole undertaking is determined by the management. The steps to be taken toward improvement in service, reduction of cost, intensified salesmanship, and the determination of the character and extent of these and all other activities rests with the management. Unwise policy or action invites disaster. Experienced and intelligent personnel alone can insure sound and expedient operation. The failure of those responsible for the organization and operation of marketing enterprises to realize how fundamental is management has been one of the most prolific causes for failure by commodity marketing enterprises. To make commodity marketing worth while at all demands that efficient management be obtained and maintained at all times during the life of the organization.

Must Market Standardized Products

To make money in any line the usual producer is not working hard for the mere love of working. He is striving to earn a living by doing something that is worth while to those for whom the work is done. Most farming is carried on to make materials for food and clothing that will sell to the consumers who buy these commodities. If a hired farm laborer, displeases the farmer it is only a question of time until he will be discharged. If farmers produce goods which fail to please consumers, the perfectly natural reaction is for consumers to pay poor prices. Poor goods and service will never average more than poor prices. It takes more satisfying goods and more pleasing service to win better prices.

Consumers want to get what they are looking for. When asking for "Sunkist" oranges they do not like to receive unkist oranges. Neither do they like to receive raisins, dried apples or dried apricots when asking for "Sunsweet Prunes."

Buyers have a right to be exacting. It is their money that they are parting with when they offer to exchange it for something that they want or need. Too often products are not put up in an exacting manner. Consequently they do not meet the wants of consumers as well as they must if the consumer is to be satisfied. Unsatisfied consumers never pay satisfying prices.

To render service that completely satisfies consumers necessitates that the products be rightly standardized in quality, size, shape, variety, color and in package. Moreover for different classes of buyers suitable packages must be used which enable them to purchase just the convenient and economic quantity for their condition of living. Besides, if consumers are to continue purchasing the same kind of product from the same source these goods must be identified. Unstandardized goods cannot be accurately nor readily identified. This is because they cannot be named. Oranges, steak and lettuce cannot be named in one package. Neither can unstandardized potatoes or apples. Each product consists unavoidably of varied units until standardization is achieved.

Why Products Must Be Named

Markets are made by people who give repeat orders. No lasting industry was ever built on a profitable basis that merely sold samples. Enlarged markets have come by appealing to a constantly enlarging group of consumers with a product which was irresistable. The power of commodity marketing is not a club; it is an unmatched product and service. Unless the producers of this sort of commodity and service find and use effective means for introducing to consumers what they have to sell, how can there be either sampling or repeat orders? To introduce a finished product to a large number of people requires an attractive appealing name. To stimulate repeat orders this name is more than ever necessary as a means of identification and protection to both consumer and farmer.

Making Products Fit the Name

Products consist of masses of individual units. The problem of naming farm commodities is, therefore, mainly a task of naming not one unit alone but of hundreds or millions of units in mass that are each, almost if not exactly alike in size, form, quality or other essential characteristics. To accomplish this work of giving the same name to the same thing on different days, weeks, months, seasons and years hinges entirely upon an adequate system. Such a system must guarantee two things: (1) that the product is rigidly standardized, and (2) that the name is attached always to the same sort of product. Generally when these two things have been done, purchasing power of farmers has been improved. This then is the secret of a name. It is a part of the road to guaranteeing satisfaction to consumers and hence better returns to farmers.

Advertising Aids Selling

For commodity marketing companies which handle finished products which are ready for use by the consumer, advertising has proved to be a valuable aid in making sales. It calls the attention of consumers who may have purchasing power to a particular product and by attractive appeal leads them to purchase a sample if nothing more. Then if the sample pleases, repeat orders follow as a consequence of the goodwill which a satisfying, named and usually prominently mentioned or displayed article builds up for itself.

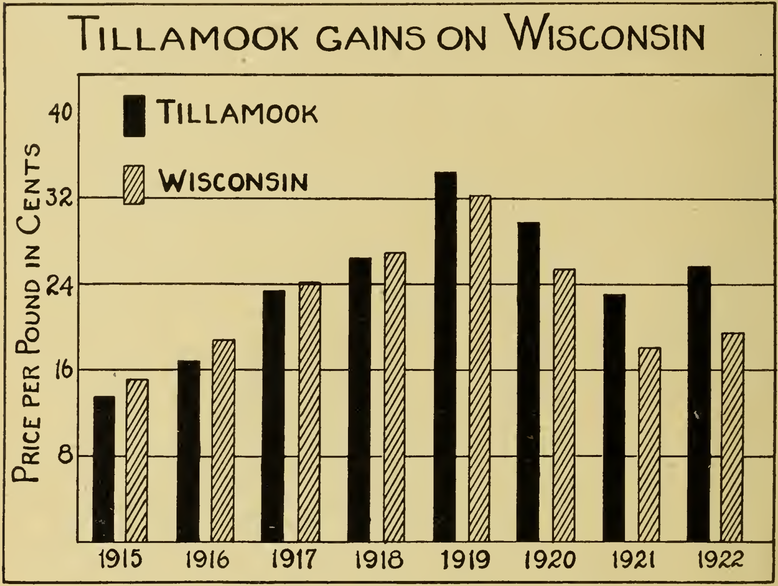

FIG. 3.—TILLAMOOK WON BY MERCHANDISING

This cooperative organization was started 14 years ago, in 1909. At the end of ten years, in 1918, it was well established but had not applied all of the essentials of merchandising. Since applying these principles during the last four years, 1919-1922, it has consistently secured better wholesale prices relatively than Wisconsin, while previously Tillamook prices were lower than Wisconsin prices.

Advertising is by no means more than a minor part of the work done by the sales system of a commodity marketing company. It is simply one item in the program which spells efficient merchandising or what might be termed selling by experts in modern up-to-date ways.

Companies Must Win Support of Trade

Most of the noted marketing systems, in fact all of them except a few localized milk enterprises[1], take the products only part way from the farmer to the consumer. Beyond the usual stopping point which is either the broker or the wholesaler there are two or three middlemen who must do their work before the commodity can win satisfaction from consumers.

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[1] The Fraser Valley Milk Producers Association of Vancouver, British Columbia for example, one of the companies aiding in making this study, owns a subsidiary retail company which has taken over the work ordinarily done by what is here termed the trade.

Let us recall an instance in which curiosity took us in quest of the articles. It may have been "Sunkist," "Eatmor," or "Sealdsweet." At any rate when the store was entered the name had slipped out of mind as may readily be the case. Now, under this circumstance if the retailer had been induced to have attractive displays in view featuring the name of the articles recommended the customer would have been at once reminded of what he was in search. Then with appealing prices tagged on the goods everything possible would have been done to make it easy for the consumer to buy. Without these reminders the product would have been passed up.

Now the task of getting retailers to stock a product on their shelves and properly to time and display pricing work upon the product is very necessary. This work must be done upon all products at the right time to fit with the demand from consumers as it is stimulated by sales effort and advertising. Otherwise the expenditures for these purposes is wasted because the consumer cannot obtain the goods when they are wanted.

Convince Wholesalers of Merchandising Plan

Before retailers can know about displaying or pricing a product, not to mention stocking it, the wholesaler must be convinced of the certainty and effectiveness of the merchandising plan. If he is led to feel that there will be a real consumer pull created for the product he will then order a supply of the commodity and enter into the task of selling it to the retailer preparatory to the appearance of consumer advertising. Unless wholesalers or jobbers get back of the proposition there is no way to land the commodity in the retailers' hands. Similarly the broker, through whom the cooperative company gains contact with the wholesaler, must be convinced of the practicability of the entire merchandising plan.

Having successfully undertaken to inform brokers, jobbers and retailers how to do their respective parts in the merchandising scheme and having inspired them to put their personality into it, all is ready for the start. Everything has been done to pave the way for the appeals to the consumer to sample the commodity. If customers are pleased after this introductory sample, repeat orders will occur. Demand will commence to grow and nothing should be permitted to happen to the product or to the service that will cause a loss of the consumer or the trade confidence that has been created.

Effective Distribution Necessary

Consumers do many things by force of custom or habit. To break into the habit of buying a given product by the common statement of the retailer "We are just out of that" and "this other something is just as good" does not help the sale of the particular named product. To continue to disappoint consumers in this way a few times dismisses from their minds the idea of buying the article you have spent money on advertising. As a consequence, then, of permitting these customers to become dissatisfied, demand falls and so do prices simply because distribution of the product had not been effective.

To make good on the advertising investment the product must be in the retail store at all times when advertising is done. This means that distribution must be guaranteed to the full satisfaction of the consumer and the trade. Without this guarantee trouble is bound to occur; and trouble means more loss and waste to the owners of the organization, to the producers of the product than to anyone else. Consumers will forget it. Their forgetting is your ruin. It takes distribution of the product to maintain worthwhile relations with the trade and with consumers.

Pay Farmer According to Product

Farm products are sold for good or poor prices because they give the buyer much or little satisfaction. Any product of whatever quality, degree of standardization, style, size or other characteristic, may be produced and marketed in relative excess or shortage as compared with the demand. Now demand is always measured in the intensity of the desire for a commodity that has certain definite characteristics. Increase in the supply of this commodity without also causing a corresponding increase in the demand for it and prices will fall. Reduce the supply without reducing demand and prices will rise. This is the inexorable law of supply and demand which commodity enterprises seek to follow to their advantage by trying to make demand keep pace with the supply at all times.

Farmers know that consumers generally are accustomed to pay most for products that are uniformly good, those that are standardized and therefore dependable in quality. But the farmer who has had fruit or cheese, or other products to sell has all too often been paid a flat price for these commodities regardless of their varying characteristics, so that more was received for portions for which demand was light than was justified while for products having a heavy demand less was paid than they were worth. In other words, while the consumer has offered a premium to induce adequate production of that particular commodity which was most in demand this higher price or premium has not been proportionally carried to the farmer. It has been disproportionally paid to him because of the widespread practise of paying flat or just average prices for all grades.

Flat Prices Penalize Quality Production

A system which pays the flat price for farm products regardless of quality "robs Peter to pay Paul." It cannot do otherwise. The man who delivered good milk to a cheese factory saw his carefully handled raw material dumped into a vat mostly filled with poorer milk. Why? All because milk is frequently not taken in on a quality basis. The best milk cannot raise the quality of the poor milk, but the poor milk brings the best down to a lower quality level. Thus the farmers who deliver poor milk receive more than their poor stuff is worth while the man delivering the best gets less.

Cheese is bought and sold not on an outright quality basis, but all too often on the basis that if the quality is poor more weight must be delivered. The cause of off-quality is hidden. In fact it is rarely chased down and corrected. As a consequence, farmers continue to be paid indifferently for their milk and no amount of argument can change the milk and no amount of argument can change the fact that this justifies merely indifferent cheese. Poor cheese under these circumstances is just what the system puts the premium on. Not until the premium is put upon the delivery of the best milk and upon the offering of the best cheese is there any hope for improved cheese marketing.

Quality Pools Place Premium Rightly

Commodity pooling means that a system is in operation by the commodity marketing organization which handles raw materials and finished commodities respectively by grades or qualities. Each quality pool is a separate accounting task. The farmer who delivers the milk that makes the best cheese that sells for the most money is assured that he will get exactly what his cheese sells for less the marketing cost. Similarly the farmer who delivers poor milk, just good enough not to turn down, but too poor to make good cheese will receive just what the second grade cheese sells for less marketing cost. Such a plan does not have anything to do with monopoly power. Pooling in this sense is strictly a device to give the farmer a square deal in prices—to give him what his product brings on a quality basis. This is fundamental in successful commodity marketing.

Pay Farmer According to Quality

No marketing system can become efficient or generally worth while and satisfactory to farmers or consumers that does not pay each farmer according to what his product sells for to the consumer. To devise a system that lets the farmer feel the consumers' pulse on what he wants to buy is one of the great fundamental purposes of the commodity system for marketing. Unless this is accomplished the whole program is a sham. If this is not done, the marketing system will defeat itself because it ignores the fact that farmers will do in the long run only what it pays best to do. It will never pay the farmer to produce the best product while a neighboring farmer gets for poor stuff the same price that is paid for the best. Commodity marketing systems with properly handled pool accounting systems are essential to correct this evil in the case of many farm products. Cheese and butter are two of these products. When given the real premium for which his better commodities sell for to the consumer the farmer will have gained one of the most vital objects to be secured through improved marketing. Another fundamental benefit is the presentation to the farmer of complete facts that concince him when the price is low or high why it was not something else. More important still he will be able to receive from the organization economic interpretations of the future tendencies of the industry in which he has confidence and upon which he can wisely decide whether to increase or reduce his production in the light of what it is costing him to produce.

Successful Commodity Companies Merchandise

With the exception of the last sentence, all of the noted successful commodity organizations named earlier, and many others in addition, have put into practice the foregoing seven fundamentals of merchandising. Leave out of the system any one of these points and a deficiency or weakness will appear that either seriously cripples or else destroys the full value of the organization.

Any program seriously interested in or hoping to improve the purchasing power of farmers must embody and adhere to these seven fundamentals, for they are the foundations of success of all the noted marketing organizations which have made the word advertising so famous. There is neither mystery nor miracle in successful commodity sales systems. Success here as elsewhere is spelled in understanding, teamwork, integrity, efficiency and in unrivaled service to the man who pays the money and consumes the product.

Merchandising Essentials Apply to Wisconsin Products

Most of Wisconsin's farm products leave the state in finished consumable form. It is these products which are best adapted to a program of improved marketing. Fortunately Wisconsin producers of cranberries were instrumental in building up the noted American Cranberry Exchange which markets the bulk of cranberries produced in Wisconsin. In moving this crop, all of the essentials of merchandising are carefully observed and strictly enforced. The success of the organization is founded upon the application of these principles. That Wisconsin farmers took an active part in developing this noted organization should be encouraging to all who are interested in hastening improved marketing for other commodities.

Wisconsin Cooperatives Adopting Principles

While the Cranberry Marketing Organization is the only cooperative enterprise in Wisconsin that practices all of the essentials of merchandising, there are other cooperatives which are doing so in part or are now paving the way to do so as soon as possible. The Wisconsin Cheese Producers' Federation is working out a program which embodies these principles in its operation. Similar development is taking place with the Door County cherry marketing enterprise.

The latest movement under way is that of the cooperative creameries of Wisconsin which are federating to apply one after another the necessary features of merchandising which conditions will justify. It is also evident that interest in the foreign cheese producing sections is crystallizing for the formation of a sales organization that will eventually apply these principles for the benefit of this important group of farmers. Progress is being made by Wisconsin farmers as rapidly as it is possible. The soundest cooperative marketing must grow from within. Its lasting strength depends upon local understanding of what cooperative marketing is and can do for those who support it. While the growth in Wisconsin seems to be a slow process it is a sound one which will develop the lasting qualities of self-supporting cooperative institutions.

What is the Commodity?

The commodity around which farmers may organize most readily is the article which the consumer buys rather than the raw material which the farm turns out. This is the case because marketing improvement is achieved not by the degree of power to force consumers to pay a price but by the ability to render a service better than ever before, thus so pleasing the consumer that he willingly bids a better price. To render this better and more pleasing service demands the keenest possible interpretation of what consumers want rather than of what farmers have produced or might tend to create in the future in the absence of knowing the correct wants of consumers.

This interpretation of consumers' wants places the emphasis upon sales work which reaches back into the farmer's plans of what to produce, guiding him to select those lines of production both in quantity and quality as will neither over nor undersatisfy the demand of buyers. Thus in dairying, the commodity is that single finished product which organization must seek to sell to better advantage. The commodity is milk for city consumption when whole milk marketing is to be improved. It is butter where dairying finds its markets through creameries, cheese where this is the article bought by consumers, and condensed milk where the raw material milk is converted into this final form.

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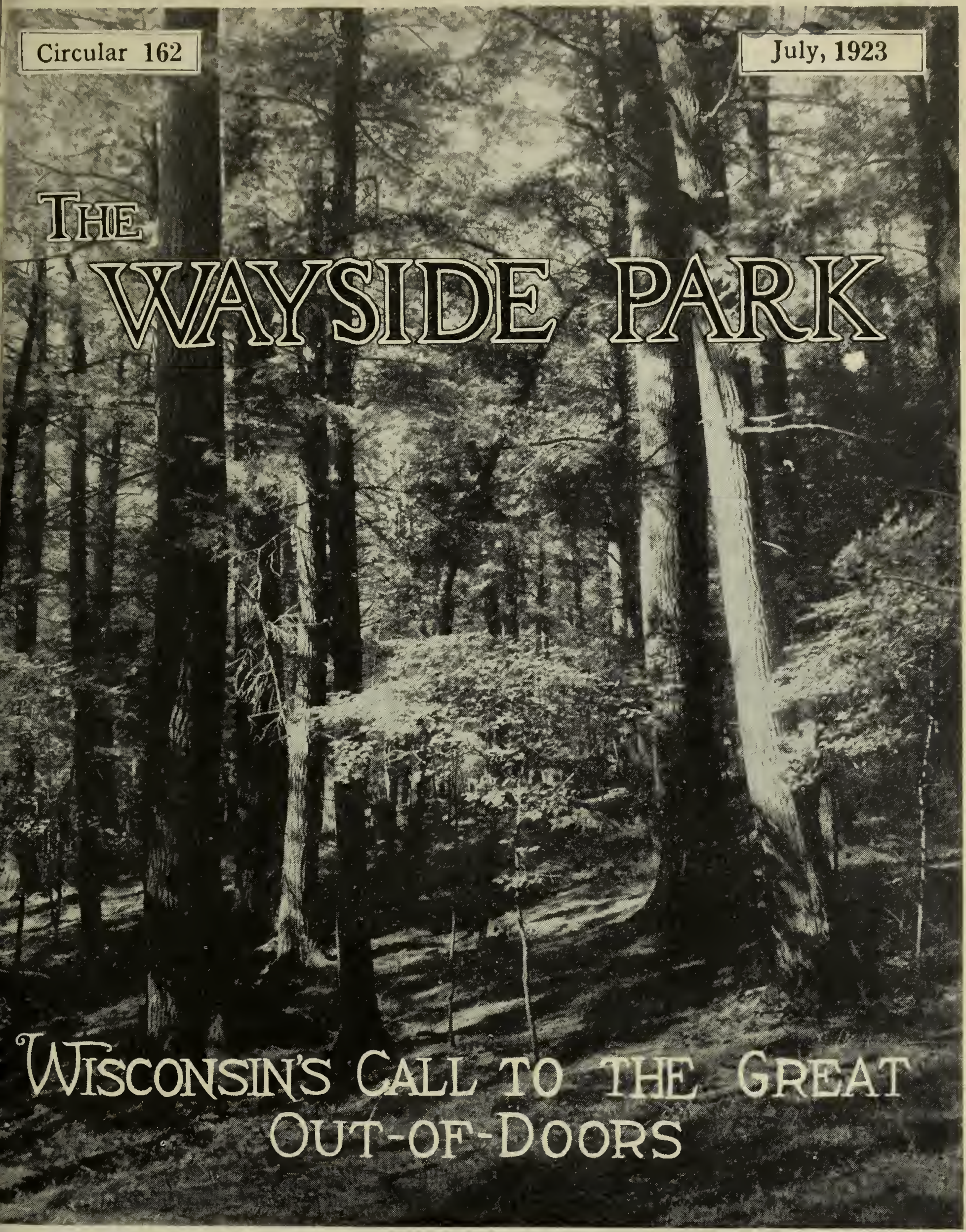


Circular 162

July, 1923

THE WAYSIDE PARK

WISCONSIN'S CALL TO THE GREAT OUT-OF-DOORS

EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN, MADISON

To the Wayfarer[*]

Ye who pass by and would raise your hand against me, harken ere you harm me.

I am the heat of your hearth on the cold winter nights, the friendly shade screening you from the summer sun, and my fruits are refreshing draughts, quenching your thirst as you journey on.

I am the beam that holds your house, the board of your table, the bed on which you lie, and the timber that builds your boat.

I am the handle of your hoe, the door of your homestead, the wood of your cradle, and the shell of your coffin.

I am the bread of kindness and the flower of beauty.

Ye who pass by, listen to my prayer; harm me not.

---

[*] This inscription is frequently found in the woods, parks and gardens of Portugal where there are timber trees.

The Wayside Park

Franz A. Aust

THE WAYSIDE PARK is Wisconsin's "open door." It extends the community's hand of welcome to every passing stranger. Moreover, it may contribute immeasurably to the development of our rural life.

The closer mingling of the folk of one state with those of another cannot but make us a nation more closely united. What is better advertising for a state than a well-satisfied visitor who goes to his home feeling kindly toward that state whose communities have cordially opened their doors to him by way of a well-equipped camping place? What is there which widens the portals of the outside world for the folk of any rural or city community so much as meeting and mingling with the America of other parts? The doors of a wayside park can indeed swing both ways.

In the coming year there will be established more wayside parks or tourists camps than ever before, yet the measure of their success or failure will depend on the extent to which they are properly planned, equipped, and supervised. A tourist camp site without the necessary equipment, care and supervision might better not be started.

Wayside Park is Needed

Never before has distance been shortened as today. Never has there been a greater longing for the out-of-doors. Never before has there been keener competition for tourist trade and patronage between the various states than today.

Wisconsin has the natural beauty, the lakes and streams, the good roads, as well as the wild life which invites the stranger and tourist to spend his outing here. It is estimated that 300,000 tourists visited Wisconsin in 1921. These, conservatively speaking, must have left more than $5,000,000 in the state during the six summer months. What has been done to attract this trade? What is to be done to provide for its future? Will it be a permanent asset to the state or will it pass as our lumbering industry has passed?

The solutions to these questions are found in the statement of Arthur H. Carhart, Recreation Engineer, U. S. Forestry Service, that "out-door recreation as all other recreation is a salable product."

A comparatively large number of recreation seekers have heretofore chosen to spend their vacation time and money in Wisconsin. Whether this will continue will depend largely upon how much the recreation facilities in the state are maintained and increased. The wayside park may play a big part in attracting tourists to Wisconsin.

Parks Valuable to Rural Communities

We sometimes object to tourist travel near our properties. It must be realized, however, that nothing could develop the state as a whole more than to have a well-pleased tourist, a satisfied customer, go back to his home state and advertise not only the beauties of Wisconsin, and its fishing and hunting grounds, but the hospitality of its people as well.

In the broadest sense, the wayside park is much more than the tourist camping ground, for it holds a very important place in the development of the rural community for these reasons.

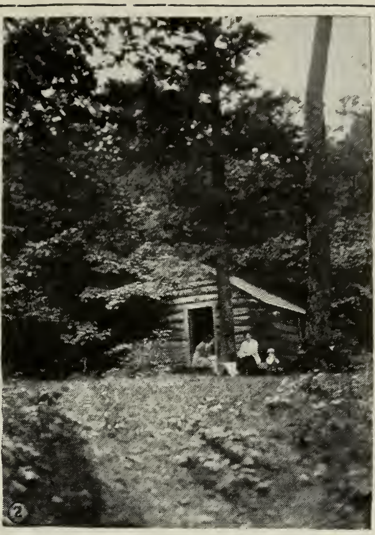
It is an important unit in the development of the state, county, and township park system.

It is a park for the surrounding community as well as for the visitors coming from distant points.

It may be made to provide the recreational facilities for the children of the community—a place for their picnics, May fetes, play days and play-a-day games. Such a provision has an increasing need and has become the recognized part of a community's duties to its youth.

Furthermore, it may mean public reservation of places worthy of preservation such as the water front, the lake shore margin, the observation point from some fine hill-top, some piece of virgin timber or fine growth of second timber, or even some place of historic interest.

From the standpoint of permanent agriculture, the campfire site or wayside park offers an opportunity for farmers to set aside pieces of waste ground to be used for park purposes and also to act as a forest and game preserve.



HIGH GROUND
A BORDER OF TREES
A VIEW OF THE LAKE —
AN IDEAL CAMP SITE

THE FOREST PRIMEVAL WITH
ITS HUNTER'S CABIN IS RARE
BUT A FEW STILL EXIST
IN WISCONSIN

A LITTLE WOODED PENINSULA BETWEEN HIGHWAY AND LAKE — AN IDEAL SITE
A WAYSIDE PARK SHOULD HELP TO PRESERVE THE BEAUTIES OF NATURE

The lack of recreative features in our rural communities also shows the need for the wayside park. Every wayside park could combine with its tourist facilities recreational features such as swings, teeter totters, and all types of playground apparatus that can be easily improvised by home labor.

Since the opportunities for social development in the country are very limited, a concerted effort should be made in every community to establish places which naturally encourages picnics, such as wiener roasts, pig fries, corn roasts, and the like. The wayside park should serve very extensively in this capacity.

Farming communities are more attractive and often more productive when trees are abundant. The wayside park helps to conserve woodland that otherwise might be destroyed.

Essentials of a Good Wayside Park

A carefully chosen location

Proper equipment

Daily care

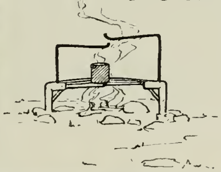
Careful supervising and policing

Selecting the Location

The usefulness of the wayside park is one of the first things to consider in selecting a location. A site should be chosen that is convenient for a large number of local people and, if possible, for a great many of the traveling public. Many sites have been selected and many more can be selected along the trunk highways passing through this state. Others can be chosen near our smaller centers of population to serve communities too small to maintain a village park. In some places such parks should be located where they will preserve for this and future generations natural features of special interest, such as a beautiful view across a Wisconsin landscape enframed by large trees. Such a site is located at the top of Wild Cat Mountain in Vernon County, or Observation Point overlooking Coon Valley, La Crosse

A GROUP OF STURDY HARDWOOD TREES NEAR A COMMUNITY HOUSE

A WISE CHOICE FOR A TOURIST CAMP



VIGOROUS SECOND-GROWTH HARDWOODS FURNISH SHELTER FROM HEAT AND PROTECTION FROM STORM

A SPOT WHICH GIVES A BEAUTIFUL VIEW FRAMED BY GREAT TREES IS A GOOD SELECTION

A WAYSIDE PARK SHOULD HAVE A WELL-CHOSEN SITE

County, or many views near River Falls, Pierce County. Other fitting locations for a wayside park would be places of special interest such as Balanced Rock, near Prairie Farm in Barron County; or Gibralter Rock near Okee in Columbia County, or Big Hill near Beloit in Rock County; or any of the many curious rock formations near Mauston in Juneau County; or the tops of Heineman, Myers, and Edminster Hills near Tomah and Sparta in Monroe County.

Sometimes places of historic interest may be featured in the camp site.

At Holcombe, Chippewa County, the local community has taken sufficient pride in its past history to preserve and use as a "Kamper's Kitchen" one of the pioneer log cabins. The sign on the old building reads:

"This building was built by Luke Lyons, 1877, as an office for the C. L. & B. Company. Let us help to preserve this old landmark." (See Fig. 7 on page 9).

The outstanding feature of the camp site at Ladysmith is a 36-inch hemlock tree trunk; the shelter has been built over and around this and the old log adds character to the entire camp site.

How to Choose a Site

If a wayside park is to be used for camping or as a tourist's park it should be in a place, preferably sheltered by trees and shrubs, which affords protection from the heat of summer, as well as from storms at various seasons of the year. On the other hand, this shelter should not be a menace or danger to those camping there. Very often areas of virgin timber are not suited for this purpose, where they are isolated and the stand has been cut from around them because big trees are often unsafe. Second growth timber often makes an ideal site because it affords protection and because of the comparative safety of the trees against breakage in severe storms. Native trees are most desirable because they usually insure a more permanent stand.

As natural a site as can be found near any city of its size is the camp fire site at Glidden, Ashland County, consisting of a natural group of hard and soft maple, elm, ash, and other hardwood trees. One of the outstanding features of the site is a thick growth of young maple which has been permitted to grow along the southwest boundary of the park next to the state trunk highway

A CAMPERS KITCHEN IS A CONVENIENCE ESPECIALLY APPRECIATED IN WET AND STORMY WEATHER

⑦

⑧

A SITE SHOULD BE LARGE ENOUGH TO ALLOW FOR THE COMFORTS AND "DISCOMFORTS" OF HOME

⑨

AN ATTRACTIVE CAMP WITH ACCOMMODATIONS FOR MOTORING GUESTS IS GOOD ADVERTISING FOR A COMMUNITY

THE PARK SHOULD BE WELL FURNISHED AND WELL CARED FOR

13. This affords ample protection to the grove so that the virgin trees will be able to maintain their original stand. Besides affording this protection they make an excellent dust screen keeping the camp site free from the dust which would otherwise blow from the nearby roadways.

The drainage should be such that it would be comparatively easy to find camping sites which would remain dry even in severe storms. A good water supply is necessary. Lake shores and stream margins often make excellent sites, but these should be sufficiently high so that there will be no danger of flood waters.

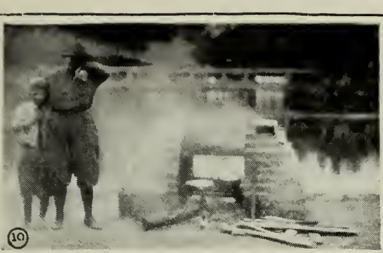
Signs Should Direct the Way

Attractive signs to direct travelers to the camp are among the first things to consider in the equipment. The need for these cannot be too strongly emphasized. Markers° are used in some communities to announce the camp sites to tourists. Sometimes the signs are placed along the state trunk highways leading into the community. If the camp site is near the state trunk highway, even within a distance of two or three miles, adequate signs should be placed on this highway giving directions how to reach the site. (Figures 36, 37, 40 and 42 show different types of signs which may be used.) For the local community, signs are not so important but it is good advertising to have them pointing the way to the site.

Signs Needed Within Park or Camp

The signs within a park or camp site are also very important. First and foremost, there should be adequate signs pointing the way to the water supply whether this is a spring, well or city supply. Different types of signs can be worked out. Very often a crotched stick is sufficient. Usually a neatly painted arrow with the word "water" written across it, and attached to trees and other supports is a good way of marking these points. Comfort stations should not be too conspicuously located but the directing arrows should be so placed that there will be no difficulty in locating these stations.

°Neenah was the first community known to the writer to use this sign.



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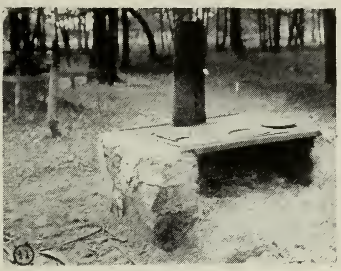
THERE ARE BOTH UPPER AND LOWER GRATES FOR COOKING ON THIS FIREPLACE OF BRICK — SMOKE IS THE ONLY OBJECTION

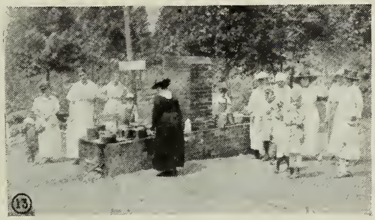


⑪

DISCARDED PAVING BLOCKS AND THE TOP OF AN OLD STOVE MAKE A CONVENIENT ARRANGEMENT

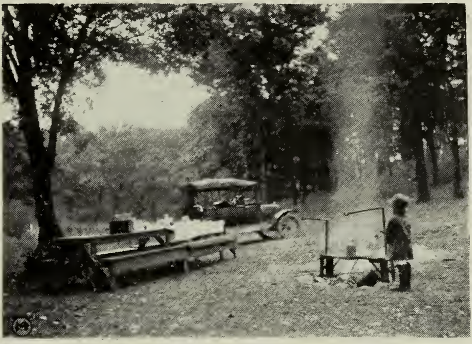
⑫

A PLENTIFUL SUPPLY OF DRY WOOD IS A REAL NECESSITY FOR THE CAMPER



⑬

TWENTY FAMILIES AT ONCE MAY HEAT COFFEE ON THIS COMMUNITY COOKER' IT TAKES FOUR-FOOT WOOD AT EACH END



⑭

FOR A SMALL GROUP THE SWINGING CRANE FORMS A USEFUL OPEN-FIRE DEVICE

TO KEEP THE CAMPFIRES BURNING IN THE WAYSIDE PARK

Camp Rules Reduce Maintenance Cost

The sign giving the rules of the camp should be found on every camp site. Such signs help a great deal in keeping the camp sanitary and are extremely educational in teaching young people the proper use of a camp site. Too much emphasis cannot be placed on the care and prevention of fires. Very often it is a good policy to erect special signs giving directions about the building of fires and where wood may be obtained.

The following rules have been found effective in one Wisconsin camp site:

CAMP RULES

1. Never throw your rubbish on the ground; either burn it or place it in a receptacle provided for same.
2. Never drive on the grass when the ground is soft.
3. Park your car in the proper place provided for parking.
4. When limited for time so that you cannot wait to put out a fire, do not build one.

Supervision of Camp Site

There are two especially effective ways of policing a camping site. One means is that of giving the caretaker of the grounds the powers of an officer. In addition to his other duties, when tourists drive in he asks them to register, and soon they expect to do so just as guests in a hotel expect to register. Another method of efficient supervising is carried out in some places where a farmer lives close by. He serves as officer and is paid for his work by the town in whose interest the tourist park exists. He, too, sees that all visitors register; he sees that lights are turned out in the park at a certain hour at night; he attends to the locking of the gates when 10 o'clock comes.

Special Equipment Useful

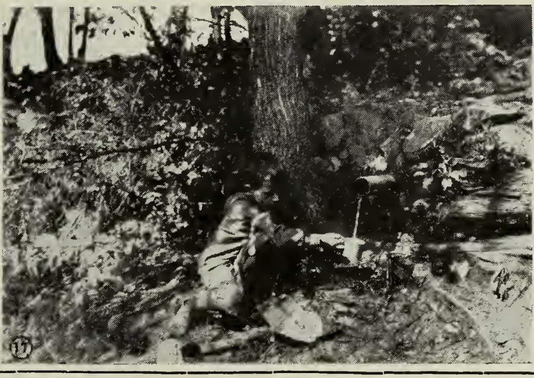
From the standpoint of the traveling public, the camper's kitchen is a very important adjunct to the camp site. This is particularly necessary in case of stormy weather. Everyone who has cooked outside will well remember the difficulties encountered

⑮

THE WAYSIDE SPRING IS A WELCOME SIGHT

⑯

BOTH THE SIMPLE FAUCET FROM CITY WATER SUPPLY AND THE MORE ELABORATE "BUBBLER" ARE HANDY AND HYGIENIC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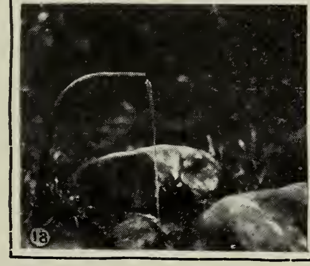
THIS SANITARY MEANS FOR SECURING SPRING WATER IS TO BE ESPECIALLY RECOMMENDED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ON SOME CAMP SITES THE ARTESIAN WELL IS A POSSIBILITY

⑲

THE OLD PUMP WITH CEMENT BASE FURNISHES A NEVER-FAILING SUPPLY

PURE WATER MUST BE AVAILABLE FOR THE WAYSIDE TRAVELER

in trying to prepare a meal on a rainy day. The equipment for such a kitchen will vary materially.

An excellent type of tourist's kitchen is found in Abbotsford, Clark County, Fig. 27. The kitchen is built of tamarack logs and the cabin is 12 by 16 feet with composition roofing. There are windows on three sides with a door in the center of the fourth side. The kitchen has a floor and foundation of cement. It is equipped with oil stove, two tables, wash stand, four straight chairs, and two rocking chairs. The pay telephone is not only convenient but aids in policing the camp. The electric lights are controlled from the main lighting switch for the entire camp. The windows are furnished with marquisette curtains. There is an oil lamp to be used in case the electric lights fail.

One of the special features in the kitchen is the tourist's register which has many bits of interesting information. Tourists are found visiting this camp from nearly every part of the United States. It might be noted that wherever a register is maintained, the walls and other available writing space are free from the usual "fools' names and fools' faces." At Glidden, Ashland County, there is provided an excellent outdoor cafeteria kitchen for local picnics. These are adequately equipped with sheltered places for the food which is being served and insulated places where kettles and pots can be kept warm.

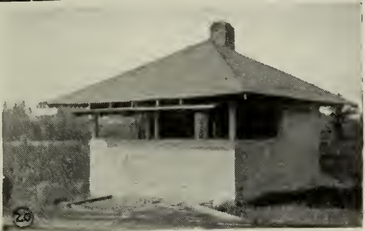
Rest Room Combined With Camper's Kitchen

A rest room in the camp is often needed and adds greatly to the comfort of the tourist. A good illustration of this is the rest room at Stevens Point. This consists of a three-walled room with decked roof 14 by 16 feet, containing two tables with movable seats. In case of rain the meals likewise can be eaten in the rest room.

Other features could be added to the camper's kitchen or rest room idea but these can be best worked out by the local communities.

Proper Lighting Helps to Keep Order

A lighting system of some kind is very important in an adequately equipped camp site. This is not always necessary where the camp site is to be used by local people only, but where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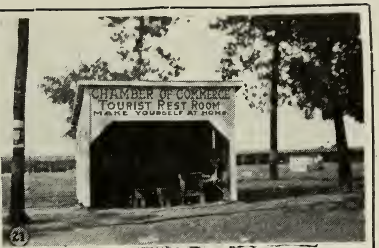

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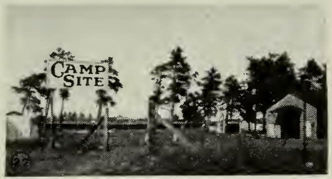

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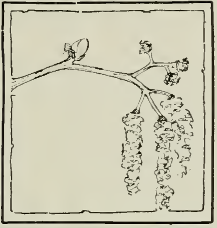

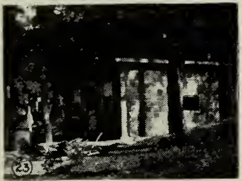
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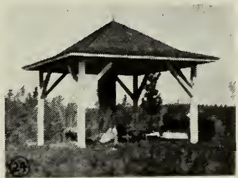
WHERE COUNTY FAIR GROUNDS AND BUILDING SERVE A DUAL PURPOSE

LAUNDRY CONVENIENCES ARE FOUND AMONG THIS REST ROOM'S FURNISHINGS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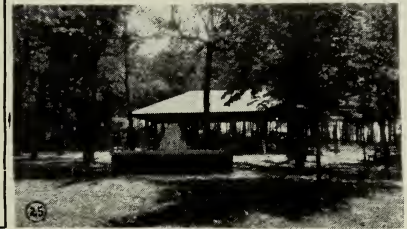
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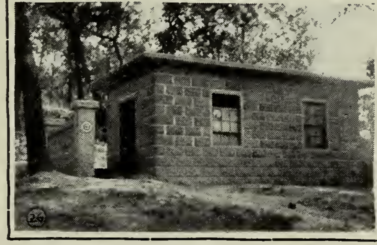
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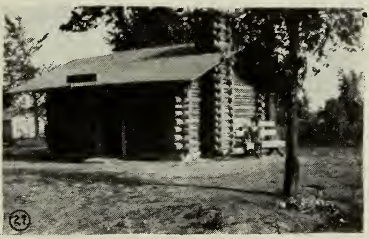
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WHETHER OF CEMENT BLOCKS OR CEDAR LOGS, THE BUILDING IS FOR THE TOURISTS COMFORT

A GOOD REST ROOM IS PART OF A WAYSIDE PARK'S EQUIPMENT it is to be used by tourists, some type of lighting system should be installed wherever possible. If it can be connected with the city lighting supply, so much the better. Electric lights in a park will lessen the labors of a park police.

Tables and Benches on Picnic Grounds

Besides the tables in the camper's kitchen or the rest room, it is necessary to have picnic tables throughout the camp site. The number of tables will vary with the size of the park. In some cases two or three tables are ample while in others there should be many more. It is also well to have some tables movable, so that they can be changed from place to place depending upon the sunlight or shade. The design of the tables may vary materially but it is usually desirable to have attached seats with the table. This is not always necessary, however, for often a small, light, movable table accommodating six or eight people and having movable benches nearby is a very desirable arrangement.

The number of benches required in the wayside park will vary somewhat with its size. Wherever the attention of the visitor is to be directed towards some observation point or attractive view, it is well to provide a seat. Where tables are provided with the attached seats, the benches can best be arranged so as to be about the same length as the tables. An excellent type of permenent bench not easily moved around by children but not too heavy to be moved by grown people when occasion arises, is shown in Figure 29. The ends of the bench are made of concrete. The cross pieces are made of oak, thoroughly oiled, so the whole scheme is practical from every standpoint. The bench can be taken apart and easily stored during the winter months.

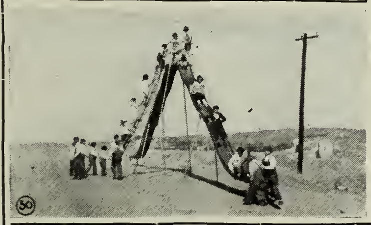
Providing Water for Camp Sites

Water is one of the first essentials for every camp site. The supply must be pure, abundant, readily accessible and easily kept sanitary. There are four common sources of water supply for the camp site.

In cities that have a pressure system for water supply a pipe could be laid from the city main. An artesian well is an

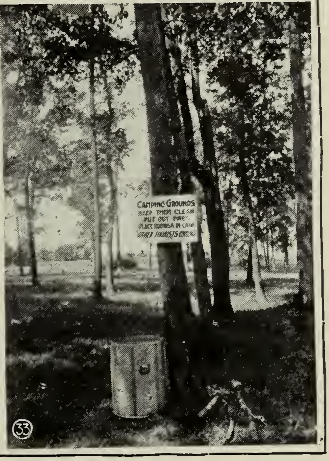
BIRCH BARK FURNITURE IS NEAT AND ARTISTIC

CEMENT ENDS AND OAK BOARDS MAKE A STRONG OUTDOOR BENCH



A PLACE TO WORK OFF SURPLUS ENERGY AND A CHANCE TO REST IN A QUIET NOOK ARE BOTH DESIRABLE

THIS COMBINATION OF A COMMUNITY HOUSE AND PLAYGROUND PROVIDES AN OUTDOOR STAGE THE STEPS MAKE COMFORTABLE SEATS



GARBAGE RECEPTACLES CHALLENGE THE VISITOR TO THOUGHTFULNESS FOR OTHERS

UNIQUE FEATURES ADD TO THE PLEASURES WHICH A WAYSIDE PARK AFFORDS excellent source of water for the camp site. This has the advantage that it is always cool, with the top securely sealed it is usually sanitary, and artesian water is usually pleasing to the public taste.

The flowing spring is another system of water supply. This must sometimes be carefully watched and is frequently difficult to keep in a sanitary condition.

Another source of supply is the driven well or driven sandpoint. In areas where the water is near the surface as on the shores of a lake or on the banks of a stream this type of water supply is possible. This, however, like the flowing spring must be carefully watched. The pump should be well elevated with preferably a tightly fitting cement top so that the water will quickly drain away on the surface, and not sink in next to the pipe and in this way contaminate the water supply.

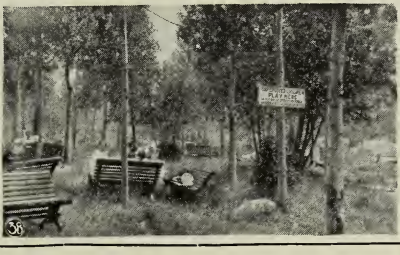
Stoves for Camp Fire Sites

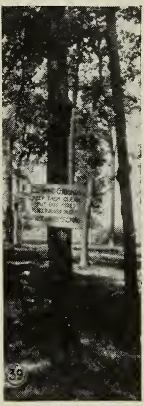
In providing stoves for camp fire sites provision should be made for the variety of tastes always found in the traveling public. Some like the open fire simply surrounded by a few large boulders or bricks. Others like an improvised stove upon which cooking utensils can be placed. A covered stove with a metal plate 6 or 8 feet long and 2 feet wide may sometimes be necessary where a comparatively large crowd must be accommodated.

There seems to be a great preference for the open fire, because it is usually very much quicker, requires less wood and seems to better satisfy man's longing for the primitive. Usually at every camp fire site you will find evidences of an open fire a few feet away from a carefully prepared stove.

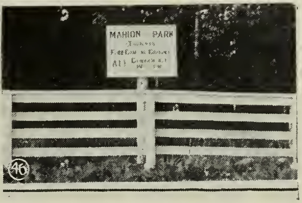
Often the best and most efficient fire-places are simply constructed from stone or brick enclosing three sides of the fire built up 10 or 12 inches. This acts as a screen and protection for the fire and also for the one holding the cooking utensils over the flame. To this type could be added an iron crane which would revolve over the fire. In this way a pail or pot could be suspended over the flame. A modified type of such a fire-place is that shown in Figure 14, the type commonly used in the parks in Minneapolis. Most every city has a discard pile of paving brick which could be used in making an outdoor camp stove.

NEAT SIGNS WITHOUT POINT THE WAY AND DIRECT THE TRAVELER TO THE CAMP





SUGGESTIONS WITHIN THE PARK INVITE CLEANLINESS, SAFETY, AND CARE OF THE GROUNDS



WELL-PLANNED WAYSIDE PARKS HAVE SUITABLE SIGNS

A good illustration of a larger and more complete equipment is that shown in Figure 13, one used extensively in the recreational park in Columbia Gardens, Butte, Montana. The advantage of such a fire-place is that it will accommodate 10 or 15 families at one time. Such a fire-place should be carefully constructed with the main body and chimney lined with fire brick.

Key to Illustrations

1. On The Shores Of Lake LaPines, Sawyer County
2. Hunters' Cabin, Round Lake, Price County
3. Mammoth Elm On The Shores Of Rock Lake, Lake Mills, Jefferson County
4. Tourists' Camp Grounds, Columbus, Columbia County
5. Tourists' Camp Site, Appleton, Outagamie County
6. View Near Cottage Grove, Dane County
7. Tourists' Camp Grounds, Holcombe, Chippewa County
8. Camp For The Night, Camden Place, Minnesota
9. Tourists' Camp Grounds, St. Paul, Minnesota
10. Camp Stove, New London, Outagamie County
11. Camp Stove, Clintonville, Waupaca County
12. Wood For The Campers, Butternut, Ashland County
13. Community Camp Site, Columbia Gardens, Butte, Montana
14. Picnic Grounds and Camp Stove, Minneapolis
15. City Water Supply, Ladysmith, Rusk County

15a. Roadside Spring Near Mellen, Ashland County

16. Drinking Fountain, Tourists' Park, Eau Claire—Chippewa Highway
17. Flowing Spring, Holcombe, Chippewa County
18. Artesian Well, New London, Outagamie County
19. Hand Pump, Clintonville, Waupaca County
20. Tourists's Kitchen, Ladysmith, Rusk County
21. Tourists' Rest Room, Stevens Point, Portage County
22. Camp Site at Fair Grounds, Stevens Point
23. Tourists' Laundry, Eau Claire—Chippewa Highway
24. Shelter Preserving An Old Log, Ladysmith
25. Tourists' Camp Grounds and Park, Viroqua, Vernon County
26. Comfort Station, Eau Claire, Chippewa Highway
27. Tourists' Kitchen and Rest Room, Abbotsford, Clark County
28. Table and Seats, New London
29. A Permanent Seat, But Movable, Appleton
30. Fun For the Kiddies on a Double Slide
31. On the Shores of Long Lake
32. Tourists' Park and Community Play Field, Fireman's Park, Waterloo
33. Tourists' Park, Appleton.
34. Tourist Park, Eau Claire-Chippewa Highway
35. Tourist Camp Site, Ojibwa
36. Marker for Tourist Camp Site, Neenah and Phillips
37. A Sign Showing the Way
38. Where Children Play, Butte, Montana
39. Tourist Park, Appleton
40. Street Sign, Waupaca
41. Sign at Tourist Park, Holcombe
42. Wisconsin State Trunk Highway Camping Sign
43. A Sign of Welcome, Neenah
44. Near Phillips
45. Near Holcombe
46. Glidden

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TURN ON THE LIGHT

Heat & Power

EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN, MADISON

CONFESSION

I am the oldest fire bug in history.

I belong to the days of the oxcart and the flail.

I have destroyed thousands of homes and desolated many lives.

I have caused the death of thousands of innocent children.

I was the cause of the Chicago fire.

I have burned up millions of dollars' worth of property.

I steal the oxygen from the air causing ill health.

I have impaired the eyesight of thousands.

I have broken farm ties and driven many boys and girls to the city.

I am a source of drudgery to the house-wife.

I have created a shortage of farm help all over the world and reduced farm production.

I should be condemned and banished from the civilized world.

I am a thing of the past. My life is about over.

I Am the Coal Oil Lamp.

Turn On the Light

F. W. Duffee and G. W. Palmer

GOOD LIGHTS in the farm home and in and around the farm buildings probably contribute more to the comfort and happiness of all members of the family than any other single modern convenience. Every member of the family uses this convenience more hours every day, and every day in the year, than any other one thing including the automobile.

The value of good, bright lights, which are instantly available by touching a button or lighting the gas, can hardly be over-estimated. Good lights make it possible to do the chores more easily and in less time, and enable the farmer to get around easily during the darkest and stormiest nights.

A light plant does away with the monotonous daily job of cleaning and filling lamps. It provides good light for reading the magazines and newspapers found in farm homes today. It is safer for children; they can go from room to room turning on the lights ahead of them, with no danger of a fire caused by an overturned lamp.

A carbide gas (acetylene) plant will provide gas for a limited amount of cooking, for heating water and for the operation of an iron, in addition to lights.

Electricity will supply current for all the labor saving devices, such as the electric washing machine, mangle, electric vacuum cleaner, electric iron, bread toaster, sewing machine, and for pumping water.

A good electric washing machine will save several hours of time as well as eliminate much hard work every week. A small motor using no more current than six or seven average sized bulbs will keep the machine going while the housewife does other work.

A flat iron can be operated with either electricity or carbide gas. It will eliminate much of the drudgery of ironing and most of the discomfort in hot weather. A small electric fan using no more current than one or two bulbs will make ironing and other work less disagreeable in hot weather.

Good Lights Save Time in Doing Chores

Chores can be done in less time with good lights than with kerosene lanterns. In 46 questionaires received from farmers, 93 per cent estimate that good lights save them an average of one hour per man each day in doing chores.

In order to get more accurate data regarding this, a test was conducted on one of the University farms, in which a man did chores one night by the aid of a lantern, and the next night by electric lights. The farm foreman who did this has had many years experience in experimental work, and was accustomed to doing chores regularly by the aid of lanterns and electric lights. The conditions were the same both nights, with the exception of the lights. The results are shown in Table 1.

TABLE 1.—LANTERN VS. ELECTRIC LIGHTS FOR CHORES

Work	Minutes to do work	
	Lantern	Electric lights
Stabling cows	4.	3
Cleaning mangers	9.50	7
Weighing and feeding grain	31.75	12
Feeding silage and hay	39.25	33
Total.. time	84.50	55

Time saved by use of electric lights—29.5 minutes—34.9 per cent.

Less Danger From Fire

Electric lights properly installed reduce the danger of fire to a minimum. However, the main electric wires are always alive, ready to cause a spark if a short circuit occurs. Proper installation is important. (Note the precautions of the Wisconsin Industrial Commission pages 7 and 8.)

Acetylene lights properly installed with well guarded fixtures and located away from danger of breakage and contact with straw or hay are undoubtedly much less dangerous than lanterns which are carried about from place to place and hung on any convenient nail, or even set on boxes or on the floor, where they may be easily upset into a pile of hay or straw.

TYPES OF LIGHTING PLANTS

The Hollow Wire Gasoline System

A ten or fifteen gallon tank of gasoline is located in some convenient and safe place. This gasoline is distributed under pressure through small tubes to the fixtures in the various rooms. These fixtures are equipped with simple vaporizers and mantles.

The advantages of this system are:

1. The cost of installation is low, being about $16 per room, and $20 to $25 for the tank and air pump.
2. The cost of operation is low.
3. The light is good.
4. The system requires but little care aside from pumping.

Its disadvantages are:

1. Each burner must be primed before it can be lighted.
2. The open flame may cause fire; many people for this reason do not wish to have these lights in the barn. Also, the open flame consumes oxygen, leaving the air somewhat vitiated, this is of great importance especially in winter time in small rooms.
3. The tubing connections are liable to leak gasoline and saturate the surrounding material thus causing fire hazard.
4. There is some danger of spilling or dripping burning gasoline or alcohol while priming.
5. Mantles must be used, and these are very easily broken.
6. There is some danger of an explosion.
7. It does not supply power for household appliances as does electricity.

Acetylene.*

In this system gas is produced in a specially constructed generator (Fig. 1) by mixing water and calcium carbide, a material resembling crushed limestone. This gas is piped to the various fixtures in the house and barn. The more modern and larger sizes of these plants have the generator placed under ground several feet from the house or any building which reduces the danger of fire or explosion to a minimum, unless some one is foolish enough to open up the generator by the aid of a lantern or while smoking.

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*See glossary page 47.

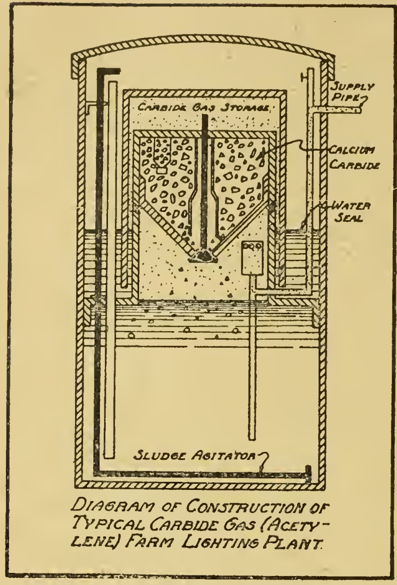
Carbide Gas Storage
Supply Pipe
Calcium Carbide
Water Seal
Sludge Agitator
Diagram of Construction of Typical Carbide Gas (Acetylene) Farm Lighting Plant

FIG. 1.—A TYPICAL UNDERGROUND ACETYLENE PLANT OF 200 POUNDS CARBIDE CAPACITY.

This type is known as the "carbide feed" because the carbide is fed into the water. This type cools better than when the water is fed into the carbide.

Its advantages are:

1. Excellent light. This light is perhaps nearer equal to sunlight than any other. The flame produces some circulation of air, which is desirable.

2. The cost of installation is moderate. The very small generators, suited only for supplying six to eight fixtures, cost $60 to $65 and require filling every few days. The larger underground generators cost from $250 to $260 and require filling only three to five or six times a year depending upon the amount of gas consumed. The fixtures and installing cost from $100 to $200 depending upon the number and grade used.

3. Carbide gas is used to some extent for cooking, heating water and ironing; if used too extensively for cooking and heating it is expensive.

(Caution—Use only the best rubber tubing for connecting the iron, and inspect it frequently for leaks.)

4. The cost of operation is very moderate if but little cooking is done, averaging $28.70 per year in 30 reports. This is for carbide alone and does not include depreciation and interest.

5. Modern fixtures have friction lighters, thus eliminating matches which are inconvenient and dangerous.

6. The danger of asphyxiation is extremely small. No deaths from this cause have been reported.

Its disadvantages are:

1. The gas is highly explosive when mixed with the proper amount of air. The usual rules for installing the generator require that it be located not closer than 15 feet to a furnace or open flame, and that all open flames must be kept away from the generator. A few cases of very disastrous explosions and fires are reported. These are undoubtedly due to improper installations or careless handling. The underground generators reduce this danger to a minimum.

Two serious acetylene explosions from farm light plants led the Wisconsin Industrial Commission to issue a warning relative to inside installation of carbide plants, as follows:

> "The generator leaked gas when a supposedly automatic shut-off failed to function, and when Mr. ——— lighted the basement burner the explosion occurred.
>
> "It is clear that faulty installation, failure of all parts of the generator to properly function, and careless management may cause such leaks at any time and an explosion must result from any light, flame, or even a spark.
>
> "We again urge the necessity of installing such generators in an outside building, properly constructed and well ventilated.
>
> "While this will not entirely eliminate the danger to life and property, it will at least reduce it to the minimum."

The use of a pit machine (which is now becoming common) located a suitable distance from any buildings should eliminate the hazard to buildings and reduce it to a very minimum against life, also the larger capacity (usually 200 pounds) reduces the number of chargings per year which further reduce the hazards.

2. It must be lighted at the burner unless equipped with a wire leading from the fixture to the point from which it is to be lighted.

3. Cleaning and recharging the generator is quite a task requiring on the average 1 $^1/_5$ hours every 1 $^3/_5$ months. The larger plants will require less frequent filling but will probably require more time. This means carrying out or pumping out 20 to 180 gallons of water and sludge and refilling with as many gallons of water and from 10 to 200 pounds of carbide.

4. The open flame may cause fire, and consumes oxygen from the air, giving off a small amount of carbon dioxide.

ELECTRICITY

Electricity may be supplied by many types of plants or over a transmission line from a central power station.

The advantages of electricity are:

1. It can be used for heat and power as well as good light.

2. Convenience. Light, heat, or power is available, either near or far away, at the touch of a button. Three-way switches make it possible to turn lights on at one place and off at another. Lights may be turned on at the barn before leaving the house.

3. Excellent light.

4. Safety. There is no open flame, and the danger of fire due to short circuits is reduced to practically zero if the wiring is properly done. However, the wires are alive 24 hours out of the day; therefore, it is essential that all wiring be done properly. When an acetylene, or gasoline light, or a kerosene lantern is turned off, there is no further danger of fire from it until a match is lighted, while the danger of an electric spark is always present unless the wiring is properly done, or the main switch opened.

Quoting again from the Wisconsin Industrial Commission:

"Because of the prohibitive expense only a few near-by farmers can connect with city plants; others must depend on private plants for electric light, heat, and power.

"These systems are of low voltage, and the dangerous theory is quite common that therefore they are free from life and fire dangers. Neither of these dangers depend solely on voltage. A strong well man may survive a severe electric shock; a slight shock may be fatal to one with a weak heart. Standing on a dry floor or a rubber mat, it may be safe to touch a knife switch or a brass socket; standing on a wet floor or in a bath, this is extremely dangerous.

"In a building where there is nothing to burn, poor wiring may do no harm. Such is not the case in farm barns particularly. The dampness of the stock barn is destructive to wire insulation, and a short circuit may at any time ignite the gathered cobwebs. In the hayloft, hay, straw, cobwebs, and dust are usually in contact with wires, fixtures, and unenclosed switches and fuse blocks. Under these conditions the slightest electric trouble may cause a disastrous fire. Conduit wiring is advisable in barns.

"All work should be done in strict conformity with the National Electrical Code. This is the standard throughout the land, and the legal standard of this state.

"Farmers can do no better than to purchase these plants, installed, from some known, reputable dealer, under contract that all work comply with said code. A reputable dealer cannot afford to let either death or fire come back to plague his conscience, because of incompetent work.

"Shun the man who tells you that these plants are free from danger and that expert knowledge is not needed to install them.

"Mr. Farmer, your buildings house ever-increasing values. You are not prepared to fight fire. Prevention is your only protection.

5. It may be used for power and heat for an iron, or bread toaster, or small reflector heater, in a limited way from small plants and more extensively from larger plants or transmission lines.

6. Extension lights are very convenient, and extension cords make it possible to move the light or power limited distances away from the fixtures.

7. Electric lights do not consume oxygen from the air or discharge carbon dioxide into the air.

8. Outside lights are not affected by rain or wind if properly installed.

Its disadvantages are:

1. The cost of a transmission line is often prohibitive, as the value of the service to the farmer is still comparatively small, due to the limited number of practical appliances that have been developed.

2. Individual plants are expensive to install and fairly expensive to operate.

3. There is some liability of shocks on 110 volt plants, not so severe on 32 volt plants.

Individual Electric Plants

The 32 Volt Battery Plant. This plant (Fig. 2) consists of an engine, a 40 volt electric generator, a control board, and a battery of 16 storage cells connected in series, giving a battery voltage of 32. This type is commonly built in 500, 750, 850, 1,000, 1,250, and 1,500 watt sizes. The 850, the 1,000 and the 1,250 watt sizes are the most popular as they seem to meet the needs of the average farm home. In 46 questionaires received, 30 per cent of the plants were of the 850 watt size and all but one-fifth of the owners were satisfied with the size.

Its advantages are:

1. The cost of the plant is lower compared to other electric plants except the 110 volt non-battery plants.

2. The low voltage reduces the danger of shocks.

3. The storage battery insures light as soon as the switch is closed and also a few days' reserve if the engine or generator gives trouble.

Its disadvantages are:

1. Special 32 volt equipment such as bulbs and motors are required. Many electrical supply stores do not regularly handle this special equipment.

2. The cost of house wiring is slightly greater than for 110 volt installations. No. 12 wire must be used with this type of plant, while No. 14 is usually large enough for 110 volt lighting circuits, although larger should be used for iron and motor circuits.

3. The current cannot economically be conducted farther than 400 or 500 feet. A No. 6 wire will supply four 50 watt bulbs at a distance of 500 feet from the plant.

4. Ordinarily it is not economical to use motors larger than ½ HP from plants of this size, and it is not economical to pump a large quantity of water with electric motors operated from a plant of this type. It costs about four or five times as much to pump water by a motor operated by this plant as it does to have a separate engine, or to do the pumping direct from a pulley on the light plant engine. The greater advantages of an automatic, electric water supply for the house are usually sufficient to warrant using electricity [illegible] purpose, particularly where the amount of water

paratively short
e for the pasted
very good care,
han two or three
essary in order to

properly care for a storage battery. The life of a pasted plate battery should more properly be spoken of in terms of complete cycles of charge and discharge, and is variously given at from 300 to 400 complete cycles, when the battery is given reasonably good care. Thus, if a battery was completely charged and discharged once each day, it would last only 300 or 400 days. The electrically formed plate type of storage battery is much longer lived, estimated at probably about nine years under average conditions, but its first cost is approximately 33 1-3 per cent higher than the pasted plate type of equal capacity.

Individual Electric Plants

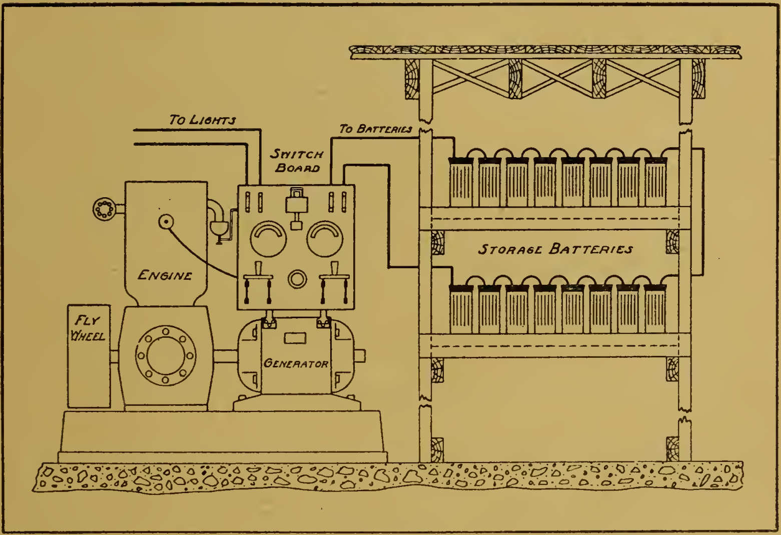

FIG. 2.—A TYPICAL 32 VOLT BATTERY FARM LIGHT PLANT.

A 110 volt battery plant would have 56 cells in the battery instead of 16, and the windings of the generator and instruments would be different.

6. The engine should always be operated when a large amount of current is being consumed as in an iron, washing machine, or other device or combination of devices, using a large amount of current. There are two reasons for this, first, this heavy load on the battery very materially shortens its life; and second, its low efficiency (60 per cent to 70 per cent normal, probably 50 per cent to 60 per cent under these

conditions) very greatly increases the amount of fuel required to do the work. A storage battery has an efficiency ranging from 60 per cent to 70 per cent under normal conditions of good care. This means that only 60 per cent to 70 per cent of the current generated and delivered to the battery can be recovered.

7. Under adverse conditions of discharging too rapidly by carrying too heavy a load; or overdischarging until the lights begin to grow dim; or charging too rapidly; excessive overcharging or gassing; or using impure water; the efficiency will drop to 50 per cent or even lower, and the life of the battery is materially shortened.

8. It is absolutely out of the question to attempt to heat the house from such a plant, other than perhaps a very small reflector heater used on chilly days; even this is very expensive and should never be operated from the battery.

The 110 Volt Battery Plant. This plant would have an engine, generator, and control board, in appearance exactly like the 32 Volt Battery plant. The generator and instruments on the control board would be constructed somewhat differently inside. The battery would consist of 56 cells connected in series, giving a voltage of 112.

Its advantages are:

1. The current can be economically transmitted greater distances. A No. 6 wire will supply four 50 watt bulbs at a distance of 4,500 feet from the plant, as compared to 500 feet on 32 volt circuits.

2. Standard equipment of all kinds except motors, can be used. Motors are more commonly built for alternating current, such as is used in cities, so that special direct current motors are required.

3. The house wiring is slightly less expensive, as No. 14 wire can be used.

Its disadvantages are:

1. The cost of the plant is higher, the battery costing about two times as much as for a 32 volt plant of equal capacity.

2. The battery depreciation and repair bill will be high, due to the large number of cells.

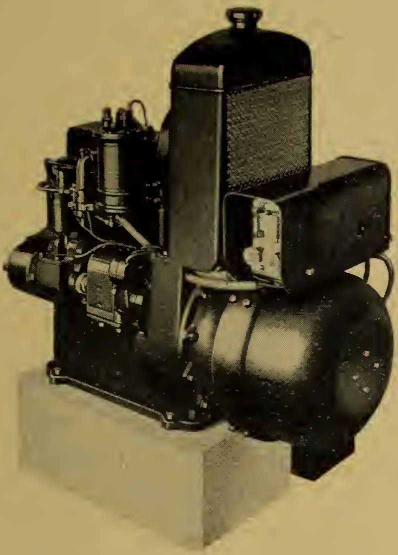

FIG. 3.—A 110 VOLT NON-BATTERY, AUTOMATIC FARM LIGHT PLANT
A small 24 volt battery is used for self-cranking

The 110 Volt Non-Battery Plant. These plants (Fig. 3) consist of an engine, generator, and switch board, and usually an automatic control box, as they are ordinarily designed to start and stop automatically when the lights are turned on and off. A small automobile type of storage battery is commonly used for cranking.

The advantages of this plant are:

1. The plant is cheaper size for size than 110 volt battery plants, the cost being about the same as for 32 volt battery plants of equal size.

2. It is built for 110 volts, thus using all standard equipment except motors, which must be for direct current. Direct current motors can be readily secured but are not as commonly carried in stock by dealers.

3. The current can economically be transmitted considerable distances as the cost of wiring is less than for 32 volt plants. (Note advantages 1 and 3 under 110 volt battery plants.)

Its disadvantages are:

1. The plant being automatic is more complicated.

2. It sometimes fails to start and supply current when needed, especially in cold weather. It should be installed where it is fairly warm in cold weather.

3. The fuel cost for current per K. W. hour is very high when only a small amount of current is being consumed. The average total annual cost is probably somewhat less than for a 32 volt battery plant and considerably less than for a 110 volt battery plant. The cost would undoubtedly be less when the plant is operated nearly up to capacity, as compared to current taken from a storage battery.

In battery plants it is always better to operate the generator when considerable current is being used.

Wind Electric Plants. These plants, of which there are a few on the market at the present time (May, 1923), consist of a special wheel head with a generator built into it (Fig. 4), a storage battery, and control board.

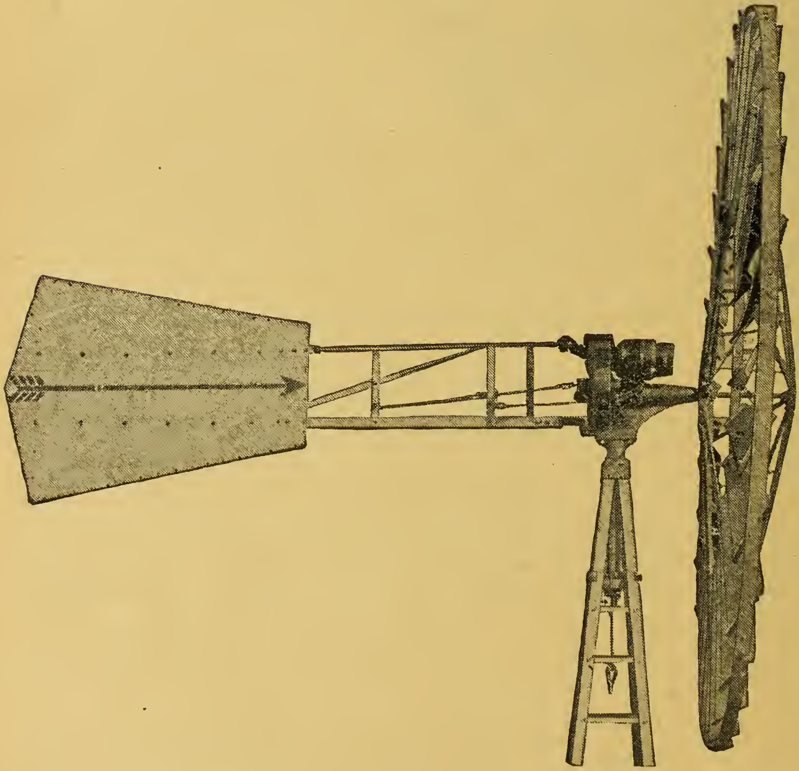

FIG. 4.—WINDMILL DRIVEN GENERATOR FOR A FARM LIGHT PLANT. The wheel and generator are specially constructed and mounted on roller bearings. This plant charges in a 6-mile wind.

These machines are new and it is therefore rather early to make statements regarding their success. However, many favorable reports have been received about plants installed under favorable conditions of wind.

The principal disadvantages of plants of this type are the extreme variation in wind velocity, resulting in an extreme variation in generator speed even in a governed mill (this means a considerable voltage variation even in a differentially compounded generator), and the large battery required to tide over calms. One company has the battery divided into two parts for charging in light breezes, charging first one half and then the other. The shift is not automatic. In heavier winds the entire battery may be charged as a unit.

It is claimed for some of these plants that quite a little of the current consumed can be taken direct from the generator. This condition is desirable as it does not work the battery, thus prolonging its life.

The cost of operation so far as fuel and oil are concerned, is of course very low, but the initial investment is higher and interest will be higher. The depreciation cost of the battery will be lower under favorable conditions of wind where considerable of the current can be used direct from the generator. Depreciation on the tower, wheel head and generator will be very small. Maintenance will also be very small especially under favorable wind conditions.

There are not sufficient data available at the present time to warrant a statement as to the total annual cost of operating one of these plants.

Hydro-Electric Plants. Many small water power plants are giving excellent satisfaction at the present time. There are many small streams in Wisconsin where a small dam could be built and a water wheel, or turbine, installed to operate a generator. Old mill sites can be developed very easily to generate electricity. If the old wheel is in working order, all that is needed will be a generator and control board (including a shunt field rheostat), and the pulleys and belting to connect the wheel and generator.

It is better to have the shunt field rheostat installed at some convenient place in the house or barn, unless the generator is so far off that the cost of the extra pair of wires would make this impractical.

Power of a Stream. The power of a stream depends upon two things, the head or fall which can be secured either naturally or by means of a dam, and the quantity of water flowing. In the usual installations a dam is built across the stream, and the water is confined and made to flow over the dam or through a side channel or mill race in which the flow may be controlled.

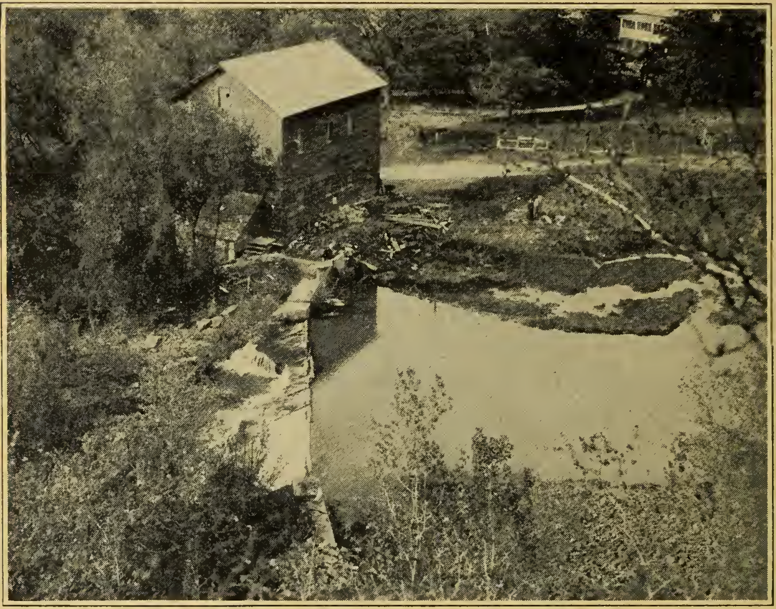

FIG. 5.—A TYPICAL WATER POWER INSTALLATION.
This is used for driving an electric generator.

Artesian wells do not ordinarily have adequate flow under sufficient pressure or head to operate even a small turbine, or wheel.

Cost of Water Power Development High. The cost of developing even a small water power is usually high so that unless enough continuous power is secured and there is economical use for it, it is better to secure power from some other source.

Other factors which must be taken into consideration are the possibility of washouts during spring freshets, droughts during the summer, and freezing up solid, or nearly so, during the winter.

Several companies manufacture wheels and turbines adapted for this work and will be glad to send literature on request. These circulars usually give much information relative to the selection of a water wheel adapted to various conditions, also water requirements and specifications. They frequently contain diagrams illustrating the construction of simple dams.

A typical example of a small hydro-electric installation is shown in Figures 5 and 6. A comparatively short masonry dam has been built across the small stream and the water is carried off at one side through a concrete race-way to a 26″ turbine. The height of the dam or the head is about 7 feet (average conditions) and the flow of the stream is about 2,400 cubic feet per minute, which gives a theoretical horse power of about 32, and an actual turbine horse power of about 25. The stream has a fairly deep channel, so that the dam does not create a pond to give a reserve of water.

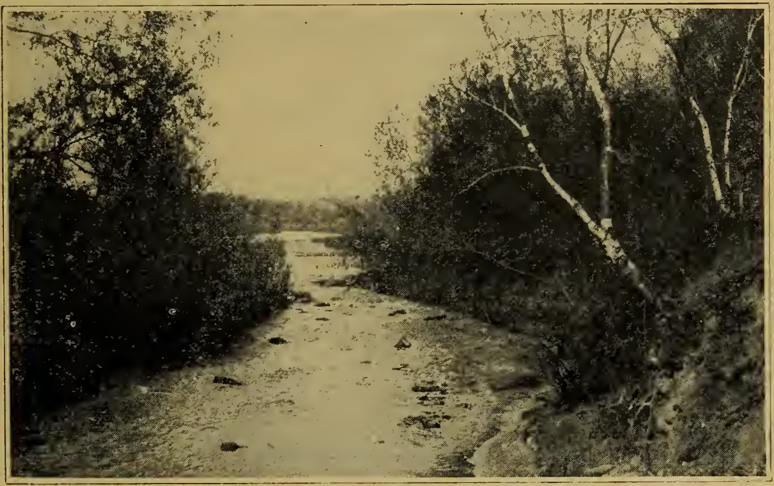

FIG. 6.—SIZE OF THE STREAM WHICH IS SUPPLYING 25 H. P.

A fair estimate of the size of the stream can be secured from the picture above. It is just a small trout stream and there are probably hundreds of places in Wisconsin that could be developed economically in this way.

The vertical shaft of the turbine drives a counter shaft through a quarter turn leather belt. Hitched to this counter shaft are an 18" attrition mill and a 12.5 K. W. 110 Volt D. C. generator. They charge eight cents and nine cents a bag for grinding, and frequently make $16 to $18 a day.

The generator supplies ample current for light and power for operating a 3-unit milking machine, and for pumping water. A heater has been installed in the milk house to keep this warm during the winter, and until recently the generator was used to keep the batteries of an electric auto charged.

Cost of the Plant. The masonry dam, which is located at the head of a short rapids, is about 3 feet high and 80 feet long, and all of the concrete work, including the short mill race and turbine penstock, cost $500 in 1916.

The 12½ K. W. generator was purchased second hand, when prices were at the highest, for $300,

The present price of a 26" turbine, such as is installed, at this place is $550 without a governor.

In order to have very satisfactory service, a governor should be installed on the turbine, and this item alone would cost about $500, (June, 1923), for the smallest size made.

If a governor is not installed, it is necessary to make an adjustment of the shunt field rheostat every time the load changes very much, and to adjust the turbine gates if there is a big change in the load.

The plant described is very practical and profitable, as sufficient power is secured to operate a good sized mill in addition to generating electricity. This, however, is not usually true as the cost of development is entirely too high for the amount of power available. Before attempting such a development, one should secure the advice of a competent engineer. A few dollars spent paying the fee of an engineer may save several hundred dollars from being invested in an impractical and unprofitable development.

The Transmission Line. The advantages of having electric service from a transmission line are as follows:

1. The consumer is relieved of the bother of operating and taking care of a plant. If he is connected on to the lines of a reliable company he can depend upon nearly 100 per cent continuous service; 56 per cent of the questionaires report that service is not interrupted often.

2. The line will supply any reasonable quantity of current by installing a transformer of the desired capacity. The line must be of a certain size to withstand storms, and this size is ordinarily much larger than is needed to supply the required current. (See page 30 on the most popular size of transformer.)

3. All standard electrical equipment is now designed for alternating current, such as is furnished by a transmission line. The usual farm transformer is designed to supply both 110 and 220 volts service. The 110 volt is used for lighting, appliances, and small motors, the 220 volt for larger motors.

4. Alternating current motors are cheaper, simpler, and somewhat more trouble-proof even than D. C. motors.

5. Under average conditions where the line will not cost each farmer more than an individual plant, an equal amount of electricity will cost less money, calculated over a period of years.

Its disadvantage is:

1. The cost of the line which makes this service prohibitive in thinly settled sections.

FACTS FROM USERS OF LIGHT PLANTS

In order to gain first hand information about the lighting situation, questionnaires were mailed to several hundred farmers scattered all over Wisconsin. Excellent co-operation was secured from a great many of these farmers and carefully filled out reports were received.

Questionaires were sent to five groups:

1. Those having electricity from Individual Plants.
2. Those having electricity from Transmission Lines.
3. Those having Acetylene (Carbide) Plants.
4. Those having Hollow Tube Gasoline Systems.
5. Those having no light plant or using lamps.

The summaries of these questionnaires are shown in Tables 2, 3, 4, 5, and 6.

TABLE 2.—SUMMARY OF QUESTIONNAIRES FROM 46 FARMERS HAVING INDIVIDUAL ELECTRIC LIGHT PLANTS.

Questions	Answers
Own your farm?	96% Yes 4% No
Did you have a light plant before?	15% Yes 78% No 7% did not answer
Do without a light plant at present cost?	100% No
Well satisfied with present plant?	83% Yes 15% No 2% did not answer
Why not satisfied?	7% prefer high line 4% too much trouble 2% no pulley 2% too expensive
Buy same type again?	74% Yes 19% No 7% did not answer
How much help did you have?	Average 2.4 men
Do chores in less time with lights?	93% Yes 7% did not answer
Time saved in doing chores?	Average 1 hour per man
Get along with less help on account of plant?	19% Yes 13% No 68% did not answer
How much less help?	15% reported 1 less man.
Keep help more easily?	32% Yes 68% did not answer
Keep children on farm more easily?	35% Yes 65% did not answer
Age of plant?	Average 4.25 years—2% did not answer
Been in continuous operation?	74% Yes 19% No 7% did not answer
Principal troubles?	28% None. 15% Engine trouble. 11% Battery trouble. 7% Switchboard trouble.
Size of plants?	2%— 500 Watts 4%—1350 Watts. 4%— 750 Watts 4%—1500 Watts. 4%— 800 Watts 2%—1600 Watts. 30%— 850 Watts 2%—2500 Watts. 15%—1000 Watts 2%—3400 Watts. 17%—1250 Watts 11% did not answer Average size—1115 Watts.
Voltage of plant?	96%—32 Volt. 2%—45 Volt—2% did not answer.
Size now preferred?	68% present size 2% smaller (Has 3400 watt plant at present) 9% larger (All of these at present have 850 watt or smaller) 2% want line 19% did not answer
Ampere hour capacity of battery?	Average 140
Ampere hour capacity now preferred?	41%—160 ampere hour 11%—larger than 160 A. H. 11%—120 A. H. 37%—did not answer
Engine direct, connected, or belter?	72% direct 28% belted
Which do you prefer?	63% direct 22% belted 15% did not answer
Why do you prefer direct?	22% less trouble 15% no belt slippage 4% less room
Why do you prefer belted?	13% other power 4% more reliable 2% simpler
Annual cost of fuel and oil?	Average $34.00—32.6% did not answer
Annual cost of labor?	Average 8.50—66% did not answer
Annual repairs to engine and generator?	Average 2.26—28% did not answer 2% report a few repairs
Annual repairs to battery?	Average 1.28—37% did not answer
Total	$46.04
This does not include interest on the investment or depreciation.	
Principal advantages of electric lights as reported on the questionnaire	72 % of total safer 72 % of total convenience 43.5% of total better light 26 % of total appliances can be operated 13 % of total saves time 11 % of total cleaner 9 % of total easier work 2 % of total cheaper 2 % of total power

TABLE 3.—SUMMARY OF QUESTIONNAIRES FROM 41 FARMERS SUPPLIED WITH ELECTRICITY FROM TRANSMISSION LINES.

Questions	Answers	
Own your farm?	90% Yes 10% No	
Had lighting plant before?	15% Yes 83% No	2% did not answer
Service interrupted often?	41% Yes 56% No	3% did not answer
Years of transmission line service?	Average 3.6 yrs.	2.4% did not answer
Approximate cost of electricity per year?	Average $68.75	12% did not answer

(This $68.75 includes depreciation and maintenance, but not interest on the investment.)

Monthly service charge	Average $ 2.55	12% did not answer
Cost of your share of line?	Average $302.00	12% did not answer
Transformer capacity (Average)?	Average 2.5 K. V. A.	27% did not ans.
Distribution line voltage?	49%— 2300 Volt	
	29% — 6600 Volt	
Which source of light do you prefer?	10%—13200 Volt	12% did not answer
Transmission line	71%	
Individual Plant	2.4%	27% did not answer
Why line?		
Less bother	51%	
More power	29%	
Cheaper	10%	
Can have more appliances	5%	32% did not answer

TABLE 4.—SUMMARY OF QUESTIONNAIRES FROM 30 FARMERS HAVING ACETYLENE (CARBIDE) LIGHTING PLANTS

Questions	Answers	
Own your farm?	94% Yes 6% No	
Be without plant of some kind?	6% Yes 94% No	
Plant give much trouble?	12% Yes 88% No	
Plant supply house and barn?	61% Yes 39% No	
Do you have fixtures outside of barn?	82% Yes 18% No	
Do you operate a stove?	64% Yes 36% No	
Are you satisfied with plant?	82% Yes 18% No	
If not, why not—		
No power	8%	
Danger	6%	
Bother	6%	
Expensive	6%	74% did not answer
Buy same type again?	64% Yes 30% No	6% did not answer
If not, what type?	30% Electric	
Age of plant? Average?	3.1 Years	
Approximate cost? Average?	$320.00	3% did not answer
Annual cost of operation? Average?	$ 28.70	6% did not answer

(This does not include interest and depreciation.)

Cost of piping and fixtures? Average?	$116.00	74% did not answer
No. of rooms lighted in house?	9	
Time to care for plant? Average?	1.2 hrs. every 1.6 months	
Main reasons for buying plant?		
Better lights	74% of total	
Safer	21% " "	
Convenient	15% " "	
Economical	15% " "	
Solicitation pressed	15% " "	
Lightens housework	15% " "	
Cleaner	3% " "	
Comfort	3% " "	
Saves time	3% " "	
Cooking	3% " "	

TABLE 5.—SUMMARY OF QUESTIONNAIRES FROM FOUR FARMERS HAVING HOLLOW TUBE GASOLINE PLANTS

Questions	Answers	
Own your farm?	75% Yes	25% No
e without plant of some kind?	100% No	
nt give much trouble?	75% No	25% Little
supply house and barn?	100% No	
ne type of plant again?	50% Yes	50% No
what type?	100% Electric	
ou satisfied with plant?	100% Yes	
of plant? Average?	11 Years	
pproximate cost? Average	$52.00	
Annual cost of operation? Average	$ 8.00	
No. of rooms lighted in house?	4	
Hours per month to care for plant?	Very small amount	
Main reason for buying plant?		
Better lights?	100%	

TABLE 6.—SUMMARY OF QUESTIONNAIRES FROM 41 FARMERS HAVING NO LIGHT PLANTS—STILL USING KEROSENE LAMPS.

Questions	Answers		
Own your farm?	85% Yes	15% No	
Ever been solicited for transmission line service?	32% Yes	63% No	5% did not answer
Why did it not materialize?			
Too expensive	17 %		
Acetylene lights preferred	7 %		
Objected to line	5 %		
Company should build line	2.4%		
Line may go through	2.4%		
Line does not supply farmers	2.4%		
What was your attitude toward it?	36.2%		63% did not answer
Favorable	39 %		
Unfavorable	2.4%		58% did not answer
Why have you not invested in some lighting system before?			
Financial	68%		
Waiting for line	22%		
Renting	10%		
Prefer acetylene, electricity or gasoline?	100% Electricity		
At same cost, prefer line or plant?			
Line	78%		
Plant	15%		7% did not answer
If line, why choice?			
No bother	44%		
Cheaper	15%		
More power	15%		
Better service	7%		
If plant, why choice?			
Farmer controls situation	7 %		
Satisfied with past experience	2.4%		7% did not answer

Appliances Used With Electricity

Tables 7, 8 and 9 show what appliances are commonly used with electric light plants and transmission lines, and what would be used if sufficient power were available. It is interesting to note that in several instances the consumers said they would use certain appliances if they had power enough, when the appliances require only as much power as two or three average bulbs. Under the individual light plant users, 9.1 per cent would operate a sewing machine if sufficient power were available, and a sewing machine requires no more current than one average bulb. This indicates a lack of information about the power required to operate various appliances.

TABLE 7.—APPLIANCES USED WITH TRANSMISSION LINE SERVICE

Use now	Equipment	Additional number that would use if sufficient power were available
62.5 %	Flat iron	6.25%
50.0 %	Washing machine	6.25%
50.0 %	Cream separator	6.25%
37.5 %	Pump water	12.50%
18.75%	Grindstone or emery	12.50%
18.75%	Milking machine	....
18.75%	Bread toaster	....
12.5 %	Silo filling	6.25%
6.25%	Buzz saw	6.25%
6.25%	Clipping machine	6.25%
6.25%	Fans	6.25%
6.25%	Churn	....
6.25%	Hay hoist	....

TABLE 8.—APPLIANCES USED WITH INDIVIDUAL LIGHT PLANTS

Use now	Equipment	Additional number that would use if sufficient power were available
68.2%	Washing machine	4.5%
63.7%	Electric iron	9.1%
41.0%	Cream separator	9.1%
36.3%	Pump water	22.7%
31.8%	Grindstone or emery	18.2%
18.2%	Fans in summer	9.1%
13.6%	Vacuum cleaner	....
9.1%	Milking machine	27.2%
9.1%	Fanning mill	4.5%
9.1%	Clipping machine	4.5%
4.5%	Bread toaster	18.2%
4.5%	Drill press	....
4.5%	Corn sheller	....
4.5%	Heating pads	....
....	Fill silo	18.2%
....	Buzz or wood saw	13.6%
....	Hay hoist	9.1%
....	Churns	9.1%
....	Threshing	9.1%
....	Sewing machine	9.1%
....	Grind feed	9.1%

TABLE 9.—APPLIANCES OPERATED WITH ELECTRICITY

(By all farmers having electricity on their farms, from whom questionnaires were received.)

Use now	Equipment	Additional number that would use if sufficient power were available
63.1 %	Flat iron	7.9 %
60.5 %	Washing machine	5.3 %
44.7 %	Cream separator	7.9 %
36.8 %	Pump water	18.4 %
26.3 %	Grindstone or emery	15.8 %
13.1 %	Milking machine	15.8 %
13.1 %	Fans	7.9 %
10.5 %	Bread toaster	10.5 %
7.9 %	Clipping machine	2.6 %
7.9 %	Vacuum cleaner	....
5.25%	Threshing	5.25%
5.25%	Fanning mill	2.6 %
2.6 %	Hay hoist	5.25%
2.6 %	Drill press	....
2.6 %	Shell corn	....
2.6 %	Heating pad	....
....	Grind feed	5.25%
....	Ice machine	2.6 %
3%	Churn	4.5%
....	Pasteurizer	2.6 %
....	Ignition for engine	2.6 %

Power Required for Various Appliances

Figure 7 will aid in determining whether your plant or transformer is large enough to handle any particular equipment or combination of equipment. As stated on the chart the number of amperes required can be determined by dividing the watts required by the voltage of the line or plant. Example: How many amperes are required to operate a 640 watt flat iron, attached to a 32 volt light plant?

640 watts divided by 32 volts = 20 amperes. Also, the watts an appliance will consume can be determined by multiplying the amperes by the voltage of the circuit.

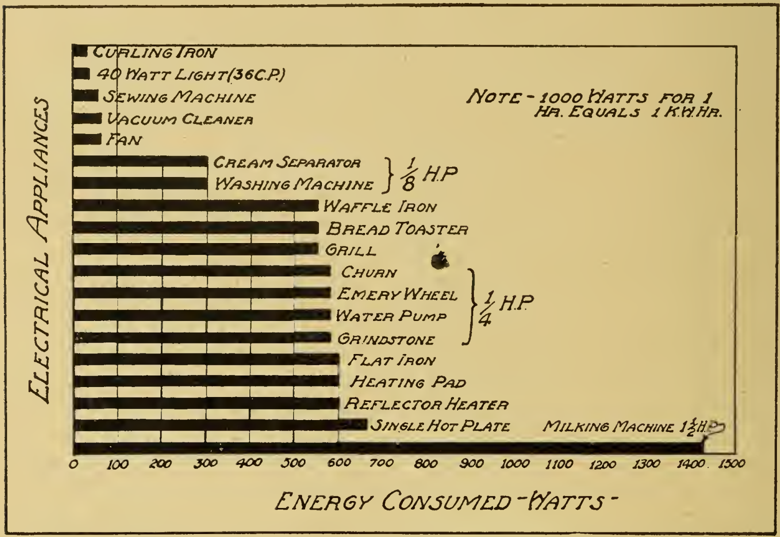

FIG. 7.—ELECTRICAL ENERGY IN WATTS CONSUMED BY VARIOUS APPLIANCES

There is some variation from these average figures in such cases as motors for the various equipment, and heating appliances, including irons. To determine the number of amperes required for the various equipment, divide the number of watts required by the voltage of the circuit.

Annual Cost of Lights

TABLE 10.—THE TOTAL ANNUAL COST OF ELECTRICITY FROM TRANSMISSION LINE SERVICE.
(Assumed cost of line—$300.)
2 K. V. A. Transformer.

Interest on investment—$300 @ 6%	$ 18.00
Cost of current— plus rural charge	68.75
Total	$ 86.75

TABLE 11.—AN ESTIMATE OF THE TOTAL ANNUAL COST OF OPERATING A 32 VOLT BATTERY TYPE INDIVIDUAL ELECTRIC LIGHT PLANT.
(Assumed Cost of Plant—$450)

Overhead expenses	
Interest on investment	$ 13.50
(½ original investment @ 6%)	
Depreciation	
Battery—$175 @ 20% (assuming 5 yrs. life)	35.00
Engine and generator—$275 @ 10% (assuming 10 yrs. life)	27.50
Tax	3.40
(Half original investment @ .015.)	
Insurance	1.00
(80% of half original investment @ $1.75 for 3 years.)	
Operating expenses	
Fuel and oil (31 answers out of 46 reports)	34.00
Labor caring for and repairing plant	8.50
(14 answers out of 46 reports.)	
Maintenance expenses	
Engine and generator repairs	2.26
(32 answers out of 46.)	
Battery repairs	1.28
(29 answers out of 46.)	
Total	$126.44

The investment is declining year by year, and the average is found by taking one-half of the original investment. While this is not absolutely accurate, it is much simpler than an accurate method and gives results only very slightly lower.

The yearly depreciation is determined by dividing the original investment by the estimated life of the plant.

Tax and insurance would be calculated on the average investment.

The items of rural charge and cost of current ($68.75) for the transmission line customers, represents the average annual cost as reported on 36 questionnaires. This coincides very closely with the typical case discussed later, where the reasons for the rural charge and its proportion of the total bill are given.

The figures for fuel consumption, oil, labor, and repairs for the individual plant are taken from the questionaires. The total annual cost of operation as estimated on the questionaires is $121.00. The estimated costs range from $35 to $351 annually. The total cost of $35 seems low, as the interest and depreciation alone on a $250 plant would amount to about $30.

The annual cost of operation will depend very largely upon how much the plant is used and the care given it. Batteries may easily be abused by over-discharging, discharging too fast, or allowing the water to get low, thus lowering their efficiency far below the normal of 60 to 70, and shortening the life to 2 or 3 years.

There is no way of finding out exactly how much current was used by the farmers reporting on individual light plants, but a study of the appliances they were using, together with a comparison of their total fuel cost with actual data on the fuel cost per K. W. hour, tends to indicate that they probably used as much as those on transmission lines. The average consumption for rural line customers is about 30 K. W. hours per month, or 360 K. W. hours annually.

By allowing this assumption, we can figure the cost per K. W. hour for current from an individual light plant as follows:

Total annual cost divided by total K. W. hours = Cost per K. W. H.

$$\frac{\$126.44}{360} = 35.05 \text{ cents per K. W. H.}$$

Comparing this with the cost of current from transmission lines on the basis of the same amount of current consumed gives the following:

Total annual cost of transmission line service....$86.75

Total annual consumption of current....360 K. W. H.

$$\frac{\$86.75}{360} = 24.1 \text{ cents per K. W. H.}$$

The cost of house wiring and fixtures will be from $100 to $250, or even more, depending upon the number of outlets, and the grade of fixtures used. The average cost is probably about $150. The house and barn wiring will be slightly more expensive for 32 volt installations than for 110 volt, as No. 12 wire should be used on 32 volt lighting circuits, and No. 14 on 110 volt circuits.

If there is a large development in the practical and profitable use of electrical equipment on the farm, the cost of electricity per K. W. H. from transmission line service will be very materially decreased. The same increase in the use of current from individual plants would mean a much slower decrease in cost per K. W. H.

TABLE 12.—ANNUAL COST OF OPERATING A HOLLOW-TUBE GASOLINE SYSTEM

(Assumed Cost of Tank and Pump—$25.)

Overhead	
Interest on investment (½ investment @ 6%.)	$ .75
Depreciation, $25 @ 5% (Assuming 20 years of life.)	1.25
Operating Expenses	
Gasoline (As reported on 4 questionaires.)	8.00
Total	$ 10.00

The cost of installing, including fixtures, is about $16 per room. Mantles will probably cost several dollars annually.

TABLE 13.—ANNUAL COST OF OPERATING AN ACETYLENE (CARBIDE PLANT)
(Assumed Cost of Plant $260—200 lb. Generator.)

Overhead	
Interest on investment	$ 7.80
(½ of investment at 6%.)	
Depreciation—$260 at 6%	15.60
(Assuming 16 years life.)	
Tax	1.95
Insurance	.60
(Some companies do not insure these.)	
Operating Expenses	
Carbide	28.70
Maintenance	
Repairs	2.50
Total	$ 57.15

The cost of house and barn piping and fixtures will vary from $100 to $200 or even more depending upon the number of outlets and the grade of fixtures used. The average is probably about $125. The burners are practically indestructible unless they are handled carelessly. Friction lighter replacements will probably cost not to exceed $1 annually.

Why Does the Rural Customer on a Transmission Line Pay More for Electricity than the City Customer?

In the first place any business undertaking either by an individual or a company, to be a desirable one, must be profitable, that is, it must pay a fair return on the capital invested after taxes, depreciation, and maintenance charges are deducted from the gross income. If the annual net profit from a rural line, constructed and handled in every way identical to a city line, amounted to 7% or 8% on the capital invested after deducting the fixed charges mentioned above, then there would be no reason why a utility company should not only be willing but even glad to construct the line at their own expense and give the service to the farmers at city rates and without any rural charge.

Many farmers do not understand why, at the present time, they cannot obtain electric service from electric companies at rates comparable to those which city consumers pay and under the same conditions, namely, without having to pay for the construction of the line, cost of transformers and an extra charge generally known as the rural charge.

Utilities are Limited to Approximately 8% Profit. Since the Railroad Commission will allow rates only large enough to permit a public utility to make a net profit of approximately 8% on their total investment, it is obvious that they cannot afford to take as big a risk as they could if they were allowed to make profits comparable with those made by some industrial enterprises. At the present time the average rural line is more or less of an experiment for the utility company. There is no past experience upon which to base their present work. Consequently, they must proceed cautiously. Public utilities are never flush with money. More often it is the other way.

Rural Line Is a Greater Risk. A rural line is a much greater risk than an equal length of city line. In the first place the liability of damage or total destruction of many miles of line, due to heavy snow, sleet, or windstorms, is much greater on the rural lines than in the cities. The elements do not have as good a chance to do their worst in the cities as they do in the long open stretches in the country. It is also quite obvious that the number of customers per mile of line is much less on rural lines than on city lines.

Rural Line Investment Is Many Times Greater Per Customer Than City Lines. Statistics show that on rural lines the average number of consumers per mile is about 2.7, while in small villages of 500 or 600 the average is usually around 35 or 40 per mile of line, and in the larger cities the number of customers per mile of line easily run as high as 200 or 300, and in some cases even higher. Thus, the cost per consumer for the line in rural districts, on a basis of the line costing $900 per mile, is on the average about $333, while in cities this investment may be as low as $50 to $75 even with a higher investment in line and transformers due to greater capacity requirements.

Why the Farmer Is Asked to Finance His Own Line. Keeping these relative costs in mind, it is evident that one or more of three things must happen if the utility company is to make a net profit. First, either the farmer must pay part or all of the cost of constructing the line; or, second, he must use a large amount of electricity—enough to make the total K. W. H. (Kilo-Watt Hour) consumption per dollar of investment at least equal to that in the cities; or, third, pay a much greater price per K. W. H. for current. As a rule the customer is asked to finance his own line, as he can do it at a lower interest rate than can a utility company, resulting in cheaper service.

Rural Lines Produce a Small Return on a Large Investment. At the present time the use of a large amount of current is out of the question for a number of reasons. Too many farmers are literally "killing the goose that laid the golden egg." That is, after they have gone to an expense of from $300 to $500 a piece to pay the cost of building a line through their territory, they hang a 50 watt bulb at the far end when it is completed. They do not seem to realize that by using as little electricity as possible they are forever cutting off the only chance they will ever have of bringing down their rates. Also there is not enough electrical machinery developed at the present time which the farmer can use profitably to make it possible for him to become a large consumer and use the service on a basis that compares to a small factory.

About the only piece of electrical machinery which a farmer can use advantageously and which consumes a relatively large amount of power is the electric motor. This is often used for running the milking machine or pumping water in sizes of ¾ H.P. or larger. Some farmers have a sort of general utility motor of 3 to 5 H.P. which they use for sawing wood, hoisting hay, and other farm operations where this

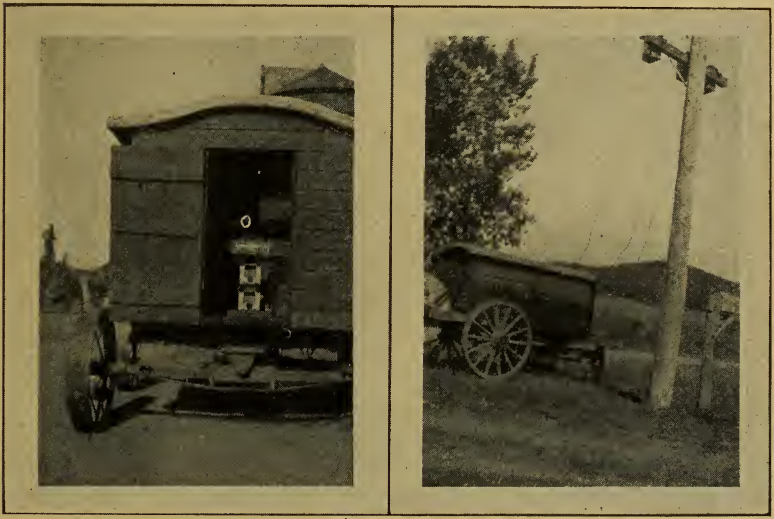

FIG. 8.—A MOTOR WAGON USED FOR THRESHING AND SILO FILLING.
This has been used very successfully on a farm near Prairie du Sac, Wisconsin.

amount of power can be used. The number of farmers who use a motor even as large as this are relatively small.

Large Motors Are Rarely Used. There are only three or four cases that have come to the knowledge of the authors where motors of 15 to 20 H.P. were being used, and then they were used only for silo filling and threshing, operations that require only a relatively few hours out of a total year's time.

1½ K.V.A. Transformers Most Popular. The most common size transformer used by farmers is 1.5 K.V.A. (Kilo-Volt Ampere), showing that at the outside most farmers do not use any more than about 2 H.P. at any one time, and this only intermittently.

Electric Cooking Usually Not Economical. Electric cooking offers a field where rural consumers may easily increase their total consumption per month, but here they are confronted with a problem the economics of which is doubtful.

With wood available either from the woodlot or at a moderate price, electric cooking is not profitable especially in the winter time, when heat is also needed. Electric cooking during the summer is of course much more satisfactory than a wood or coal range or an oil or gasoline stove. The heat is ready in a very short time, and it is very uniform and dependable.

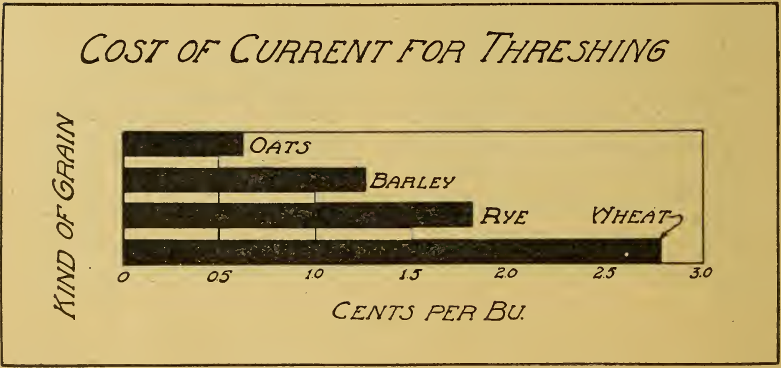

FIG. 9—AVERAGE COST OF CURRENT PER BUSHEL FOR THRESHING GRAINS.

The electric motor is used as a source of power. These figures represent the average of two or three cases reported during a fairly favorable year.

A given amount of heat from electricity is much more expensive than from coal, wood or gas, but the efficiency is much greater.

One investigator reports that that "in ordinary household cooking only 2% of the heat value of the coal used in the kitchen range under the usual conditions reaches the food; with gas from 15% to 25%; with electricity from 50% to 60% on the open top boiling units and from 80% to 90% in the oven."

A very low rate usually applies for all current over 10 to 30 K. W. H., but even so the bill for this current will be rather high. One company reports that customers bills for electricity for cooking, range from $4 to $6 per month. It is to be understood this is for cooking alone and does not include current for lights or power nor does it include an item corresponding to the rural charge.

Experiments conducted at a "Practice Cottage" at the Washington State College, where cooking of three meals a day over a period of a number of weeks was carried on, indicate that the cost per week of cooking with coal, wood and electricity are:

With coal at $11 per ton, 88.5, cents per week; with wood (fir) at $11 a cord, 89 cents per week; with electricity at 3.85 cents per K. W. H., 86.5 cents per week.

Greater Consumption of Current Means Reduced Rates.

Every farmer should realize that if he ever hopes to have rates and other conditions of electrical service on a par with those of near-by cities, he must increase his consumption. He can do this by adding to his supply of electrical machinery and appliances as he finds he can make economical use of them, taking into consideration of course not only money saved, but such things as added comfort for himself and family, more leisure time, convenience, and hosts of other things that cannot be measured directly in dollars and cents, but which he would not do without once he has had them.

If each and every farmer on a rural line will look at the problem in this way, and if those farmers who have a transmission line passing their farm, but who have not joined on to it with their neighbors yet, will connect as soon as they can possibly do so the time will not be far off when rural rates will begin to come down, and rural charges will become smaller and smaller.

As the cost of the electricity to the farmer becomes less, he can afford to use more of those electrical machines and appliances for which he has longed. This, in turn, will increase the income per mile of line, and tend to bring about a further reduction in rates. In other words, if electricity is to cost less to the farmer he must realize that the responsibility rests largely with him. The more electricity he uses the cheaper will rates become.

Many Uses for Electricity Other Than Lighting Being Developed. The farmer must use a larger quantity of electricity if he wishes reduced rural rates. This means the development of many uses for the current other than lighting. Furthermore, to be economical, these uses must be distributed uniformly day by day throughout the year. See chart Fig. 10. Time alone will tell what these uses will be.

The interest and activity along these lines indicate that we may expect a tremendous development of practical and efficient electrical equipment for farm use in the near future, so that the farm will approximate a small factory in the economical use of electricity.

What Is the Rural Charge? The rural charge in most cases is the difference in the cost of rendering rural service and city service. These expenses are known as fixed charges, energy losses and operating expenses.

Fixed Charges, include interest, taxes, depreciation, insurance and maintenance; in other words, items which are practically fixed and do not vary with the energy output of the plant.

Energy Losses cover all losses incident to transmitting the power from the electric generators to the consumers' lamps or motors. The main energy losses are transformer core losses which are constant; transformer copper losses which vary with the current consumed and line losses.

Operating Expenses are those which are incurred in the conduct of the business and which vary more or less with the volume of business handled. Such items as office expense, labor cost, and fuel cost come under this last class.

The sum total under rural conditions of these various expenses compares with that under city conditions as follows:

Under Fixed Charges. The interest on the money invested in the line per customer would be many times greater for rural than for city lines as the investment is many times greater. Taxes would probably be less, while depreciation, insurance and maintenance would be considerably greater for the rural lines. Then the total of all fixed charges will be many times greater for a rural line customer than for a city customer.

Under Energy Losses we have the transformer core losses and copper losses going on in the transformer installed at each farm and in the big transformers at the sub-station where the electricity is changed from a higher voltage, such as 66,000 down to 6600 or 2300 for distribution along the rural lines. The construction of a transformer is necessarily such that it takes current all the time, whether it is being used or not. If this were not true, you would not be able to turn on your light or start your motor any time of the day or night. These transformer core losses going on 24 hours every day and 30 days every month mean a considerable loss of energy each month. (See Fig. 10.) The ordinary size transformer used by farmers is at present about 1.5 K.V.A. The core losses for this size transformer are about 21.5 watts. Over a period of a month this would amount to

$$\frac{21.5 \text{ watts x } 24 \text{ hrs., x } 30 \text{ days}}{1000} = 15.5 \text{ K. W. H.}$$

This loss alone which is going on every month at every farm house having rural line service is about 15.5 K. W. H. per consumer or approximately half as much as he uses.

The average size transformer used for city customers in residential districts is probably about 7.5 K.V.A. and would supply from 30 to 40 customers. The core losses in this size transformer are approximately 55 watts. For an entire month this would amount to 39.6 K. W. H.

$$\frac{39.6}{30 \text{ to } 40} = 1.32 \text{ to } 0.99 \text{K. W. H. per month per city consumer.}$$

This item alone would cost the rural customer about 35 cents more per month than the city customer. The line losses in either case are relatively small and do not affect the other energy losses sufficiently to warrant consideration.

A Comparison of Actual City and Rural Losses. A better understanding of this may possibly be secured by a study of the recorded losses on a large number of rural and city lines.

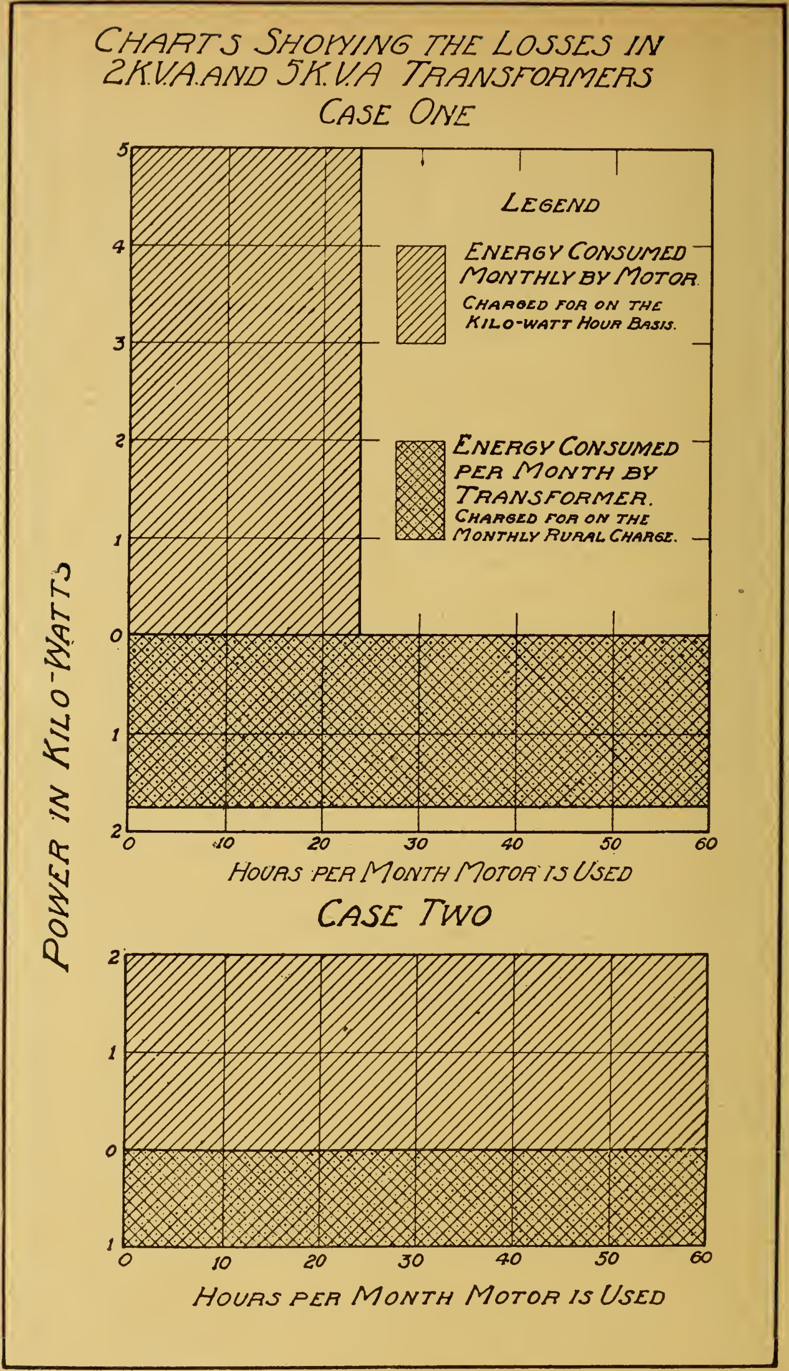

FIG. 10.—CASE ONE REPRESENTS A FARMER WHO HAS A 5 H. P. MOTOR.

He needs a 5 K. V. A. transformer. The lined area shows the amount of energy he uses per month by operating the motor 24 hours per month on the average. This equals 120 K. W. hrs. The large shaded area represents the energy wasted by his transformer every month. This amounts to 103 K. W. hrs. (Kilo-watt hours), or nearly as much energy as he uses in the motor.

CASE TWO REPRESENTS A FARMER WHO USES AS MUCH ELECTRIC ENERGY PER MONTH AS THE OTHER FARMER, BUT HAS A SMALLER (2H.P.) MOTOR AND USES IT A GREATER NUMBER OF HOURS.

He needs only a 2 K.V.A. transformer. The energy wasted in his transformer is only a little over one half (59 K.W. hrs.) that in the larger transformer and therefore he pays a smaller rural charge.

On 23 rural lines serving 976 customers, the recording meters showed that only 54.6% of the current put on to those lines could be accounted for by adding up the readings of the watt hour meters at the various farms along the lines. In other words 45.4%, or nearly one half of the total energy put into those 23 lines was lost between the generator and the consumers' meters. (1923 Report Rural Lines Committee, Wisconsin Utilities Association.)

On city lines the average loss is only about 18 per cent, due largely to a higher load factor in the transformer; or, in other words, the transformer is used more nearly up to its maximum capacity all the time.

Scheduling Rural Rates. There are no special laws or regulations as yet regarding the rural problem in this state. However, all schedules of rates must be filed with the Railroad Commission and receive their sanction before being put into effect, and changes cannot be made without their sanction.

One method proposed is that the rural rate be made up of two parts: The first part to consist of the regular rate charged for service in adjacent cities; and the second, a rural charge. This rural charge is to consist of the difference between the fixed charges, energy losses and operating expenses incident to rural service and the corresponding items for city service. In making this comparison of expense it is suggested that it be made on a basis of equal incomes.

To take a concrete example. Suppose the total above mentioned expenses in an annual income of $25,000 amounted to $10,000 for city business, and for the same income on rural lines the corresponding expenses amounted to $10,850. Then the total rural charge would be the difference between these two figures, or $850. If there were 27 farmers on the line the portion each one would pay on an equal basis would be

$$\frac{\$850}{27} = \$31.48 \text{ per year, or } \$2.62 \text{ per month.}$$

A code was prepared by the 1920 Rural Lines committee of the Wisconsin Utilities Association, as a basis for the building and operation of rural lines. This code has the sanction of the Wisconsin Railroad Commission although it is to be understood that the Railroad Commission did not initiate the plan, but sanctions its use as reasonable and just. This code provides that the line be financed by the farmers and built either by or under the direction of the utility, so as to insure safe standard construction. The reasons for asking the farmer to finance his own line have already been set forth.

The Rural Lines committee recommends a somewhat different and perhaps fairer method of determining the individual rural charge. They suggest the annual rural charge shall be equal to:

1. 10% of the total construction costs of the extension, **plus** the total transformer core losses per year, computed at the utility's power rate, **minus** 27% of the revenue from the annual consumption of current figured at the regular urban rates.

2. Then, the annual rural charge for each consumer would be determined as follows:

50% of the total annual rural charge of the entire line would be apportioned equally among the consumers.

50% of the total annual rural charge would be apportioned among the consumers according to installed transformer capacity.

3. One-twelfth of the annual rural charge so apportioned to each consumer would be billed monthly by the utility and paid by the consumer as a monthly rural charge.

This method of figuring the rural charge has been found to give practically the same results in a great many typical cases tried, as when the amount by which the fixed charges, energy losses, and operating expenses incident to rural service exceed the corresponding items for city service, is found and then apportioned among the farmers.

The Utility Maintains the Line. The item of 10 per cent of the original cost of the line which constitutes a large portion of the rural charge consists largely of a charge for depreciation and service. According to the contract the company agrees to service and to maintain the line in return for this 10 per cent charge so that the farmer, once having invested his money, is relieved of future reinvestment except for the monthly rural charge.

Why the 27% Is Deducted. In cities the total cost of rendering service is included in the charge for current, and there is no special charge corresponding to the Rural Charge for rural customers. However, in a survey of 25 Wisconsin cities it was found that approximately 27% of the total revenue for current was to cover "fixed charges" consisting of profit, depreciation and taxes for the line: "1920 Report Rural Lines Committee; Wisconsin Utilities Association."

Therefore, if the rural customer finances his own line, and pays a special rural charge to cover depreciation and taxes,

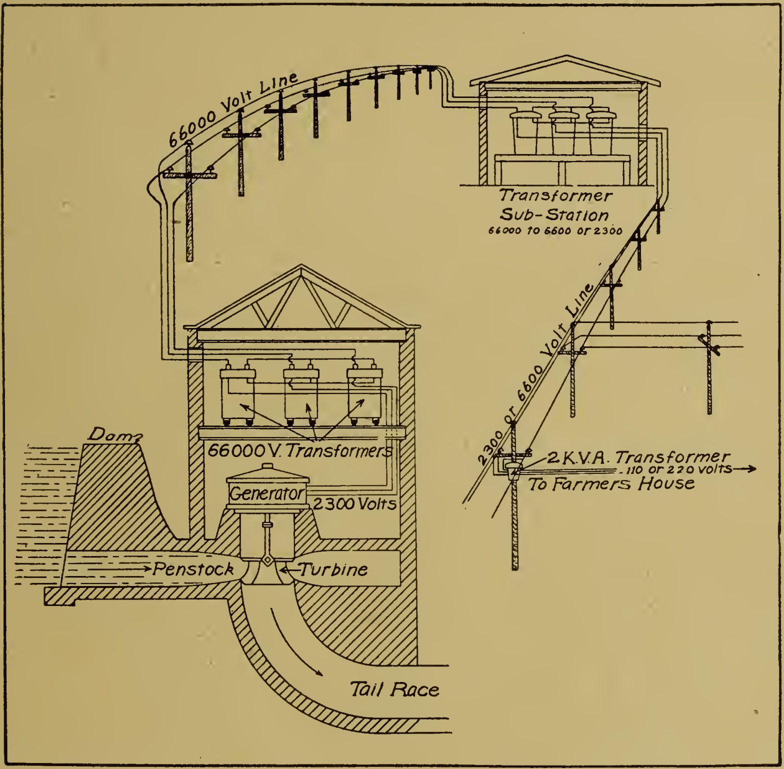

FIG. 11.—A HYDRO-ELECTRIC GENERATING STATION AND DISTRIBUTING SYSTEM.

The power plant, transmission lines, transformers, and transformer substations are shown.

27% of the total charge for current at city rates should be deducted from his bill, and this is done.

In order to make this method of figuring the rural charge a little clearer, take an example as nearly typical as possible. Suppose a group of farmers have organized and financed the construction of a rural line ten miles long. When completed, assume this line cost approximately $9,000, or an average of $900 per mile. Suppose also that the average number of farmers per mile is 2.7 (this figure is obtained from average statistics on rural lines). This would give us a total of 10 x 2.7 or 27 farmers on the line.

Now assume that 20 of these customers have installed 1.5 K.V.A. transformers; 5 are using 3 K.V.A.; and only 2 have 5 K.V.A.

The monthly rural charge of each may be figured as followes:

(1) Ten per cent of the total construction cost of the line is $900.

(2) To compute the total transformer core losses:
The loss in a 1.5 K.V.A. transformer is 21.5 watts
The loss in a 3 K.V.A. transformer is 32.5 watts
The loss in a 5 K.V.A. transformer is 41.5 watts

$$\frac{21.5 \text{ watts x } 20 \text{ customers x } 24 \text{ hours x } 30 \text{ days}}{1000} = 309.6 \text{ K.W.H.}$$

Figured in the same way the loss in the five, 3 K.V.A. transformers would be 117 K.W.H. and in the two, 5 K.V.A. would be 59.7 K.W.H.

The total monthly core losses would be:-

$$309.6 + 117 + 59.7 = 486.3 \text{ K.W.H.}$$

If the utility's power rate is 4 cents per K. W. H., this core loss will cost 486.3 K.W.H. x .04 = $19.45 per month and $233.42 per year.

(3) To determine the 27% of the total income from the sale of current.

Statistics show that the **average** K.W.H. (Kilo-watt Hour) consumption on rural lines is about 30 K.W.H. per consumer per month. (1923 Report of the Rural Lines Committee, Wisconsin Utilities Association, Page 8—an average of 976 customers on 23 lines).

Assume that each of the 20 farmers with 1½ K.V.A. transformers consume 24 K.W.H. monthly, each of the five with 3 K.V.A. transformers consume 40 K.W.H. and the two with 5 K.V.A. transformers each consume 72 K.W.H. Now if we take average urban rates as 12c per K. W. H. for the first 20 K.W.H. 10 cents for the next 20, and 8 cents for all over 40 K.W.H.

The total monthly revenue from the line would be \$91.80 and the total annual revenue \$91.80 x 12 months = \$1101.60. Twenty-seven per cent of this is \$297.00.

Summary

(1) 10% of the total cost of the line	\$ 900.00
(2) Cost of total transformer core loss	233.42
Total	\$1133.42
(3) Minus 27% of the revenue from the consumption of current	\$ 297.00
(4) Net total rural charge for the line	\$ 836.42

Now to apportion this:

50% equally among the customers, and,

50% prorated according to installed transformer capacity—

50% of \$836.42 = \$418.21 divided equally among 27 customers gives \$15.49 each.

Then we figure each farmer's share of the remaining 50% to be as follows:—

Each of the 20 farmers with 1.5 K.V.A. transformers will pay \$11.41 per year.

Each of the 5 farmers with 3 K.V.A. transformers will pay \$22.81 per year.

Each of the 2 farmers with 5 K.V.A. transformers will pay \$38.02 per year.

The total yearly rural charge for each of the:—

Twenty farmers would be \$15.49 + \$11.41 = \$26.90.
Five farmers would be \$15.49 + \$22.81 = \$38.30.
Two farmers would be \$15.49 + \$38.02 = \$53.51.

and the monthly **rural** charge of each of the:—

Twenty farmers would be	\$2.24
Five farmers would be	3.19
Two farmers would be	4.46

and the **total** bill for the month for each of the:—

Twenty farmers would be \$2.80 + \$2.24 = \$5.04.

Five farmers would be \$4.40 + \$3.19 = \$7.59.

Two farmers would be \$6.96 + \$4.46 = \$11.42.

It will be noted that these rural charges differ somewhat from the uniform charge of $2.62 figured previously under the same physical conditions, but by a different method. The farmers with the 5 K.V.A. transformers may think a monthly rural charge of $4.46 for them is unfair, when compared with only $2.24 for those with 1.5 K.V.A. transformers. However, the justice of the apportionment will no doubt appear to them when they realize that a 5 K.V.A. transformer causes about 2 times the core loss that a 1.5 K.V.A. transformer causes.

The fewer the relative number of farmers with 5 K.V.A. transformers or larger, the greater will be the discrepancy between their rural charge and that of the farmers with smaller transformers. Therefore, if these proposed rules for determining the rural charge for each consumer, as well as his total monthly bill, are adopted by all utilities it at once becomes apparent that the farmer must get away from using a transformer having a capacity greatly in excess of the majority on the line, if he does not want to pay a much higher rural charge than the rest of the customers on the line.

This can be accomplished more or less satisfactorily by each farmer giving a little thought to the electrical machinery he installs. He should avoid as far as possible installing a motor, for example, requiring a 5 K.V.A. transformer and which is used only occasionally, when the largest size any othr farmer uses is one requiring only a 2 K.V.A. transformer. See Fig. 10.

Use Small Motors Rather Than Large Ones. This is not meant to discourage farmers from increasing their consumption of electricity, for that is necessary if they are to minimize or eliminate the rural charge and obtain cheaper rates. There are many ways in which a farmer can profitably increase his consumption of electricity without going to electrical machinery requiring large amounts of power.

For instance, suppose a farmer were contemplating buying a motor for pumping water. He could buy a large motor which would pump his daily required amount of water in perhaps a half hour, or he could buy a much smaller motor and keep it running 5 or 6 hours every day to pump the same amount of water. The small motor would be the one to purchase, other things being equal, since he could use a small transformer and the power consumed would be relatively small but would extend over a long period of time and the losses would be small—a desirable condition. With the large motor a large amount of power would be used, but would be required for only a short time—a very undesirable condition from the standpoint of the utility company. To make this last point clear, suppose each farmer of this group of 27 farmers, had in addition to the necessary lights about the house and barn and perhaps a flat iron, a 3 H.P. motor which they used only night and morning for the combined work of operating the milking machine and pumping water. This would be a sure load which the electric company would have twice a day for perhaps an hour each time. They would have to provide generators and transformers of sufficient size to meet this peak load amounting to about 300 H.P. twice a day, in addition to the usual load at that time, and the rest of the day this equipment would stand more or less unused. The farmer is the one who would have to pay for such a condition as that. Of course, it is an extreme case, but it illustrates the undesirability of occasional big loads.

The ideal condition would be to have each farmer use his full transformer capacity all day long, but this of course is out of the question. However, what each farmer should try to do is to approach this condition in so far as he is able.

By the installing of proper household appliances and machinery, the rural consumer can do much toward distributing the load throughout the day. For instance, a modern farm equipped with electric service from a transmission line might well have use for all the following electrical machinery and household appliances:

Motor for milking machine (1½ H.P.)	1400 watts
Motor for pumping water (½ H.P.)	770 watts
Vacuum cleaner for house	210 watts
Motor for cream separator	300 watts
Washing machine	300 watts
Bread toaster	600 watts
Electric flat iron	660 watts
Electric lights	700 watts
Total	4940 watts

If all this equipment were used at the same time the total consumption of electricity would be 4940 watts, and if this load lasted any length of time at all it would require the installation of a 5 K.V.A. transformer. This same equipment could easily be operated off a 2 K.V.A. transformer with a proper distribution of the load. Any other one piece of equipment could be used at the same time as the milking machine motor was being used without overloading the transformer to any extent. See chart Figure 12.

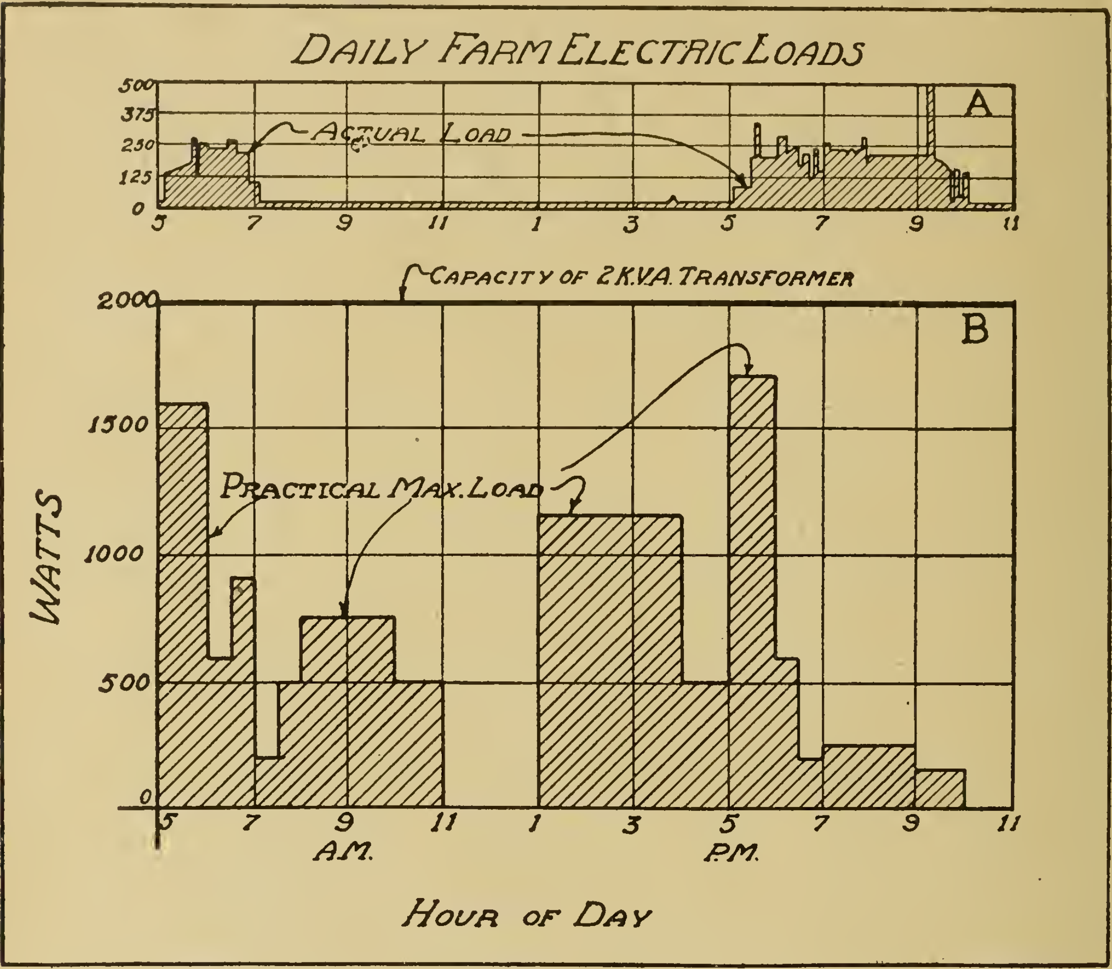

FIG. 12.—(*Lower Chart*)—A GOOD PRACTICAL LOAD FOR A RURAL CUSTOMER.

This load is adapted to a farmer using such electrical equipment as a washing machine, electric iron, vacuum cleaner, and water supply system. It shows also that under even the best practical conditions it is far from ideal as he is not using his transformer up to approximately full capacity, except for a short time each day.

(*Upper chart*) An actual customer's load taken during late winter.

The conditions probably equal about the average of the year. Rural charges will remain high until these loads are increased, and more evenly distributed throughout the day.

The pump motor could very nicely be run three hours each morning and afternoon if necessary, and once or twice a week as required the washing machine or flat iron could be operated at the same time. Any combination of equipment might be used at one time, so long as the total consumption did not exceed 2000 watts for a very long period. A transformer will carry a large overload capacity for a short time or a small overload for an hour or two.

Chart Fig. 12 shows in a graphical way what might be considered the best that could be expected in the way of a farm load at the present time, both as to average magnitude and hourly distribution throughout the day. In this hypothetical case the farmer was assumed to have the electrical equipment listed above, but its use was distributed in such a way throughout the day as to require the farmer to have only a 2 K.V.A. transformer instead of a 5 K.V.A., as explained above. The shaded area represents the various amounts of power used at different hours during the day. The white area represents the amount of power that was not used but could have been used during the same time from 5 o'clock in the morning to 11 o'clock at night. It is easily seen that the clear area is much greater than the shaded area. Actually, the shaded area represents 11.25 K.W.H. while the entire area or the total power that could have been used represents 32 K.W.H. Therefore only 35.2% of the total available energy was used. If this energy had been distributed uniformly over the entire 16 hours the power consumption would have been .64 K.W. and a ¾ K.V.A. transformer would have been more than large enough for the purpose.

Therefore, even in the best kind of a load that could be expected from a rural consumer the required transformer capacity is much larger than would be required for a uniform load throughout the day with the same energy consumption.

There is more or less of a tendency on the part of farmers to install a larger transformer than is needed to handle their load. This practice is to be discouraged except where an early increase in the load up to the transformer capacity is anticipated.

THE DISTRIBUTION OF ELECTRICITY ON THE FARM

Computing Size of Wire Required for a Given Circuit. The size of wire required for any circuit or portion of a circuit of a given length is determined by two things:

1. The allowable drop in voltage between the source of supply and the point where the current is used.
2. The maximum amount of current to be used at any one time.

Where good reliable service is desired the allowable drop is pretty definitely fixed at about the following values:

On 32 Volt Circuits:
- (a) 1 to 2 Volts for lighting circuits.
- (b) 2 to 3 Volts for motor circuits.

On 110 Volt Circuits:
- (a) 3 to 5 Volts for lighting circuits.
- (b) 5 to 10 Volts for motor circuits.

On 220 Volt Circuits:

Twice the amounts given for 110 Volts.

A greater drop in voltage will result in dim lights or reduced speed of motors.

With the allowable drop practically a fixed quantity, the size of wire is really determined by the amount of current to be carried and may be calculated as follows:

$$\frac{\text{Length in feet x amperes carried x 11}}{\text{Loss in Volts}} = \text{area of wire in circular mils.}$$

To solve a concrete example:

Suppose we wish to know what size wire we should run from the transformer to the barn, a distance of 150 feet, where we are using three motors, which use at full load, 15, 7, and 4 amperes respectively, at 110 Volts.

In the case of motors the allowable voltage drop is from 5 to 10 on 110 Volt circuits,—let us assume 7.5 allowable drop. The distance one way is 150 feet, giving a total of 300 feet of wire. The amperes carried are $15 + 7 + 4 = 26$.

The formula is

$$\frac{300 \text{ x } 26 \text{ x } 11}{7.5} = 11{,}440 \text{ circular mils}$$

Now if we refer to our wire table and look under circular mil area we find that 13,090 C.M. is the closest to the computed value, since we must take the next larger size rather than the next smaller.

13,090 C.M. is the area of a No. 9 wire, which should be used in this case.

We can go a step further and figure the weight of copper required for the wires; No. 9 wire weighs 39.63 pounds per

1,000 feet. We require 300 feet or .300 x 39.63 = **11.9** pounds.

If we had decided to use a smaller allowable voltage drop our required wire size would have come out a little larger and if we had chosen a larger voltage drop than 7.5 we could have used a smaller wire than No. 9.

However, the limits given above for lighting circuits and motor circuits should never be exceeded in either direction for if exceeded in the smaller direction the cost of copper will

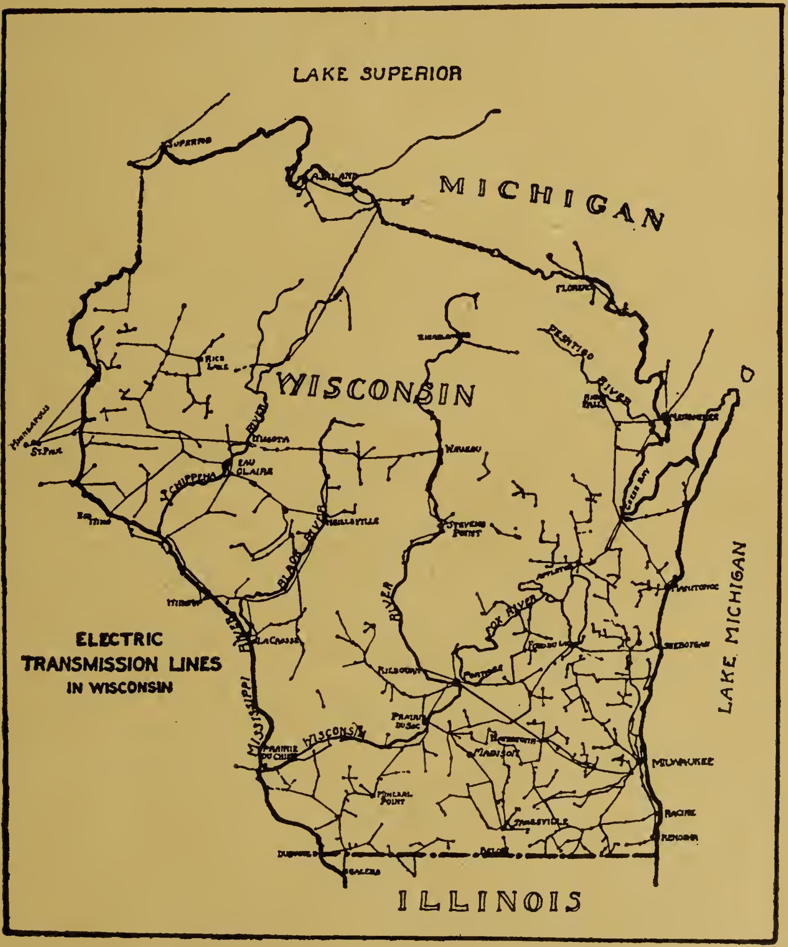

FIG. 13.—TRANSMISSION LINES IN WISCONSIN ON MAY 15, 1923. (Courtesy Wisconsin Railroad Commission.)

become excessive without a proportionate gain in quality of service and if exceeded in the other direction, the service will be poorer to the extent of diminished lights or lower motor power.

TABLE 14.—WIRE DATA TABLE

Gauge	Circular Mil Area	Pounds per 1000 ft.	Feet per Pound
0	105500	319.5	3.13
1	83690	253.3	3.94
2	66370	200.9	4.97
3	52640	159.3	6.27
4	41740	126.4	7.91
5	33100	100.2	9.98
6	26250	79.46	12.58
7	20820	63.02	15.87
8	16510	49.98	20.01
9	13090	39.63	25.23
10	10380	31.43	31.82
11	8234	24.92	40.12
12	6530	19.77	50.99
13	5178	15.68	63.80
14	4107	12.43	80.44

Glossary of Terms

Acetylene (carbide gas)—An illuminating gas produced by bringing together calcium carbide and water.

Volt—The unit of pressure under which the electric energy flows in any circuit. Corresponding to pounds pressure in a water supply system.

Voltage—The pressure under which the electric energy flows.

Ampere—The unit of rate of flow of an electrical current corresponding to gallons per minute in water.

Watt—The unit of power of an electrical current corresponding to horse power. Volts multiplied by amperes = watts. 746 watts = 1 horse power.

Kilo—The Greek word for 1000.

Kilo-watt—(K. W.)—1000 watts = 1 1-3 horse power approximately.

Kilo-watt hour (K. W. H.)—The unit for measuring the amount of power consumed over a period of time. 1 K. W. (1 1-3 H. P.) used for 1 hr. = 1 K. W. H. of energy consumed.

Kilo-volt ampere (K. V. A.) refers to the capacity of a transformer. A 1.5 K. V. A. transformer would have a capacity up to the point where the product of volts times amperes did not exceed 1500. At 100 per cent power factor the K. W. capacity equals the K. V. A. rating.

Ampere hour (A. H.) rating referring to storage battery capacity means the total number of ampere hours the battery will deliver during a complete discharge. There are three methods of rating:

(1) **Normal 8 hour rating** (constant discharge). This is the oldest and most severe rating employed by battery manufacturers. It means the battery will give its normal ampere hour capacity when the discharge is distributed evenly over a period of 8 hours continuous operation; that is, a 160 ampere hour battery when fully charged will give 20 amperes for 8 consecutive hours without discharging below the recommended limit of 1.75 volts per cell.

(2) **The A. I. E. E. rating.** This is the recommended rating of the American Institute of Electrical Engineers and is based on a capacity at the 8 hour rate of 50 ampere hours per square foot of positive plate surface, taking into account both sides of the plate.

(3) **Intermittent rating.** In this rating advantage is taken of the recuperative power of a storage battery, and the discharge instead of being distributed over a period of 8 hours continuous operation is extended over a period of 72 hours with certain definitely specified periods of rest to allow the battery to recuperate.

8 hour rating	A. I. E. E. rating	Intermittent rating
60	64½	84
120	125	168
160	167	224

The intermittent rating gives a rating 40 per cent higher than the constant 8 hour rate. In purchasing batteries be sure to find out which rating is used.

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Circular 164 September, 1923

BLASTING

What to do & How to do it

THE LIBRARY OF THE
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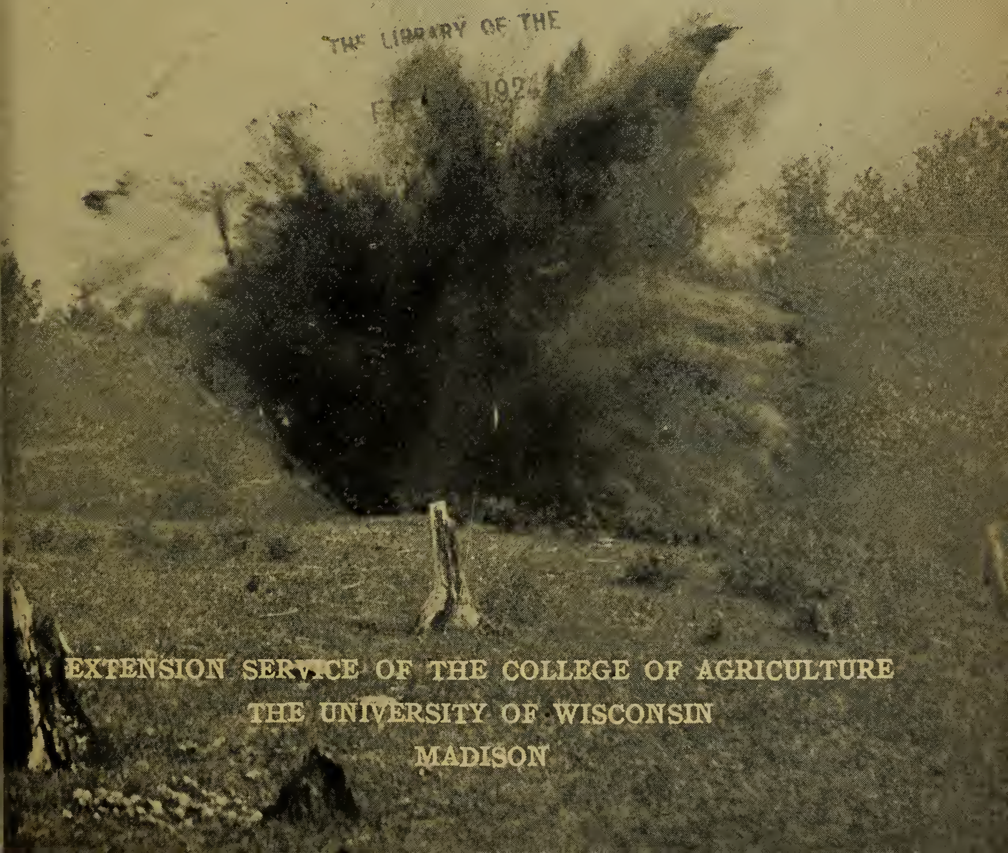


EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN
MADISON

Save on Explosive Costs

Blast when soil is wet,—in spring or late fall.
Use low-grade, low-priced dynamites for stump blasting.
Use high-grade, high-shattering dynamites for rock work.
Get charge well bunched and well under holding part of stump.
Tamp every hole well. Do not allow explosive gas to get away without working.
Use war explosives while they last. They are cheaper.
Pool explosive orders with your neighbors to get benefits of car-lot distribution.

Blasting

JOHN SWENEHART AND W. A. ROWLANDS

THE USE OF EXPLOSIVES in land clearing has increased in the past five years from a few hundred thousand pounds up to the present consumption of between three and four million pounds a year. Most of this is used by farmers who never used explosives before settling on their present farm.

The methods and materials originally used in blasting stumps were largely adopted from mining practices. Many good blasters were recruited from among the miners who settled upon cut-over tracts. But many practices were introduced in this way which while not necessarily dangerous when done by experienced men, were dangerous when done by beginners. Moreover, familiarity has often bred contempt, and many explosive accidents have occurred among these old timers. These early blasters also knew only "40 per cent" explosive. They do not readily adopt cheaper or better materials and methods.

Better distribution, better priming, better loading, better tamping, and proper storage of explosives, caps and fuse will reduce the cost of clearing cut-over land. The waste through improper tamping alone has caused much unnecessary loss in agricultural blasting.

MATERIALS NEEDED

Low grade and cheaper dynamites do stump work as well or better than higher grades.

For a long time it was thought that high grade, quick acting, expensive dynamites were necessary for stump blasting. During the past few years it has been proven that low grade, less expensive dynamites will do the work equally as well. Due to the slow heaving action rather than a quick shattering action, even better work often can be done with the low grade dynamites. It was really not the grade of dynamite but the improper way in which it was used that kept up the belief that the quicker grades were necessary. Failure to put the bore-holes in the right places and improper tamping had much to do with making high grade dynamites seem necessary. When these details are handled correctly, the low grades will do the work as well or better and at a lower cost.

The suggestions in this bulletin are not the result of any one man's work. Better methods of agricultural blasting however, were largely introduced by Alfred Mathewson. Many leaders in demonstration work including the authors acknowledge his teachings. He worked tirelessly for the development of explosives suited to the needs of land clearing and other agricultural work.

Modern Explosives Are Safe and Efficient

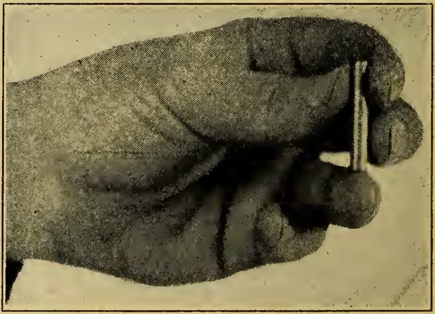
Modern dynamites are a mixture of explosive materials. Many different materials are used in the various brands. They are not affected by ordinary temperatures; and thawers are unnecessary.

Salvaged war explosives such as TNT, picric acid and others are prepared in cartridges similar to dynamite. These explosives as prepared for distribution are to be used like ordinary dynamites.

Several so-called specials having more cartridges per pound are being introduced. Experience will show how well they compare with ordinary low grade dynamites.

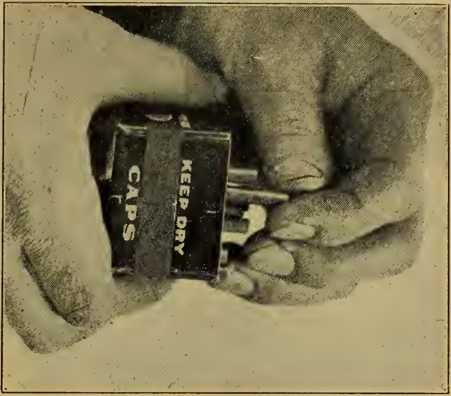
A common No. 6 blasting or detonating cap is dangerous when not properly used. Handle it carefully. The copper shell is filled with sensitive shattering explosive. It is exploded by fire or heat, by friction or by shock. Keep the caps dry and do not leave them in direct sunlight as they may get hot and explode more easily.

Keep matches, cigars, or cigarette ashes away from caps. Keep caps where children cannot get at them. Note precautions on box.

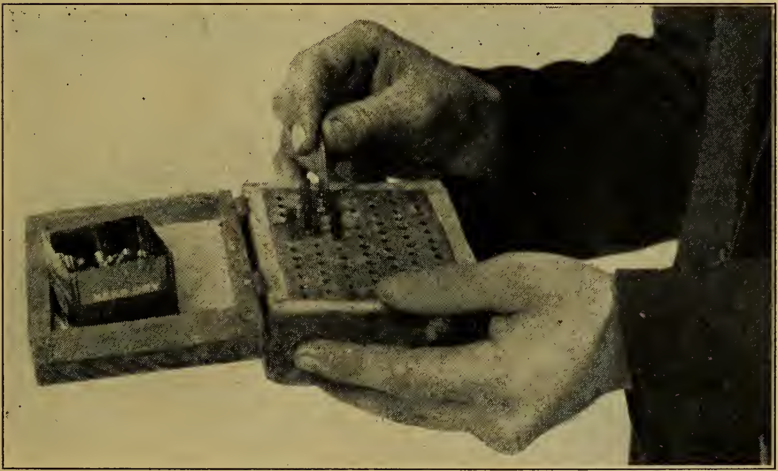


Blasting Caps Set Off Explosives

Carefully take caps from box in which they come and put in safety cap box. Matches or nails should never be used to pull a cap out. Tip the box over as shown.

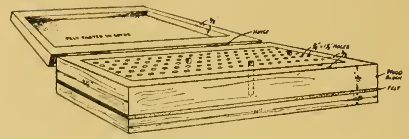


Remove Caps with Care



The Box May Prevent an Accident

Anyone can make a handy cap box to carry caps safely in the field. It will save time and lessen danger.



Make Your Own Cap Box

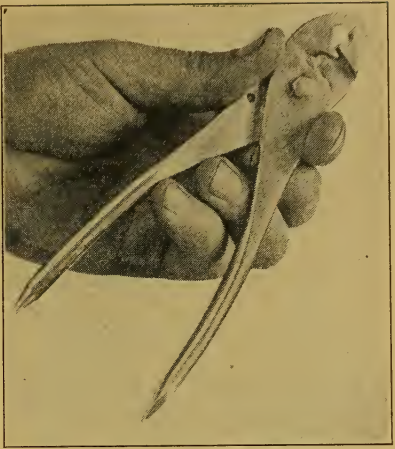
The materials to make a cap box are found on every farm. Such a box is handy, easy to make, and most important, may prevent a bad accident. Make dimensions to suit.

Using Fuse Right Requires Skill

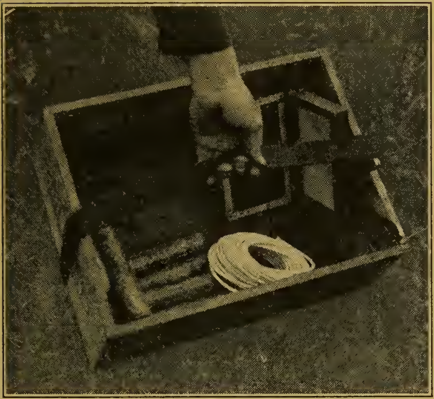
Safety fuse comes in a package of two fifty-foot rolls, one wrapped inside the other. Clover Brand is probably the best all-around brand. It burns at a rate of about 40 to 45 seconds per foot. Crescent and Anchor Brands are good but burn at the rate of about 30 seconds to the foot. Poorer grades of fuse should not be used for agricultural blasting.

Fuse must be kept dry. When cold it should be handled carefully so as not to break or injure it. In very cold weather it may pay to keep it warm. Sharp bends should be avoided. If fuse becomes pinched or kinked, cut out that portion. Damaged fuse means misfires or hangfires, a dangerous thing in blasting.

A good cap crimper should always be used. It promotes both safety and efficiency. Tie it to the carrying or loading box so it is not lost.



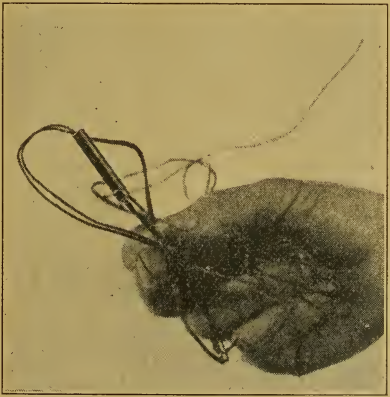
A Cap Crimper is Not a Luxury



All Together Where Needed

Use a dynamite case to make a handy carrying box. A leather strap nailed along the edge forms loops to hold knife and cap crimper.

An electric blasting cap is needed for electrical blasting. It has the same explosive material as a common cap but is set off by a fine wire in the cap which is heated red hot by the electric current from a blasting machine. Different length wires can be secured but 4′ wires are most common. A number of these caps can be wired together and fired at the same time. No fuse is used. Wires cannot be used again in another cap as they are built in the cap. All caps should be handled carefully.



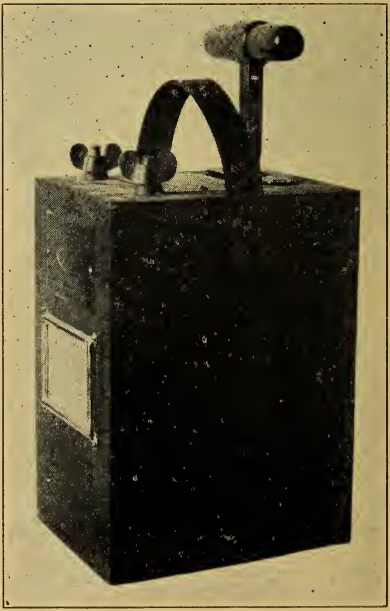
Electric Method is Simple and Safe

A Regular Leading Wire Beats Makeshifts

Leading wire is a double insulated wire that permits the operator to stand at safe distance out of danger when firing the charge; 250 to 300 feet is used in agricultural blasting. The two wires are separately insulated and enclosed in one cover.

A small generator or blasting machine furnishes current to set off electric blasting caps. It is not a battery. It is simple to use and will last a long time if kept dry and given ordinary care. Blasting machines are made in various sizes to fire up to 150 caps although the large sizes are seldom needed. The ten cap size is the one most commonly used in stump and general work.

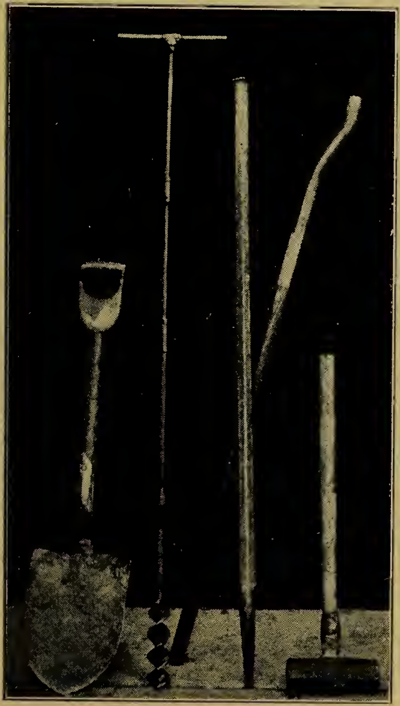
Dry batteries or storage batteries can be used to set off a few caps but their use is not recommended on account of the danger of accidental discharge. Dry cells in series will fire about one cap per cell. Spark coils ordinarily available are of little practical value. A blasting machine is safer and better. Cooperation among neighbors reduces cost of ownership.



A Generator but not a Battery

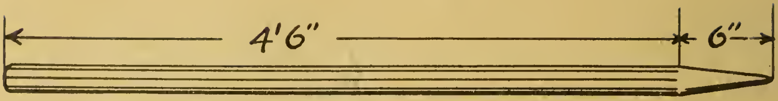
When loads several feet apart must be connected for firing at once, 20 to 24 gage insulated wire known as connecting wire is used. Often short pieces of cap wires are picked up after blasting and saved for connecting up. Connecting wire is secured through regular dealers handling explosive supplies.

Connecting Wire Comes Handy



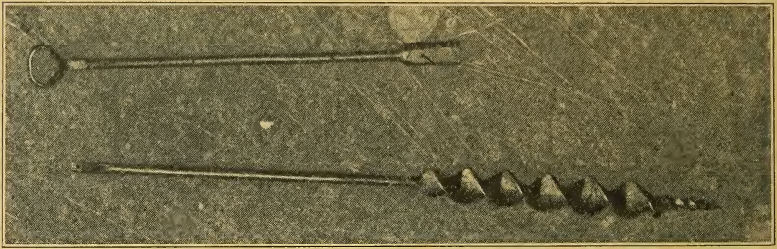
Good Tools Save Explosive

Some dynamite tools are those commonly used about the farm. A crow bar works well for shallow holes but is not good for larger stumps. The shovel is needed to get soil for tamping.



Make a Driving Bar of Available Materials

The 8-sided shape makes removal easier but a similar bar may be made of any steel shaft available about 1½ inches in diameter. It can be used as a punch without the sledge. It will have many uses about the farm.



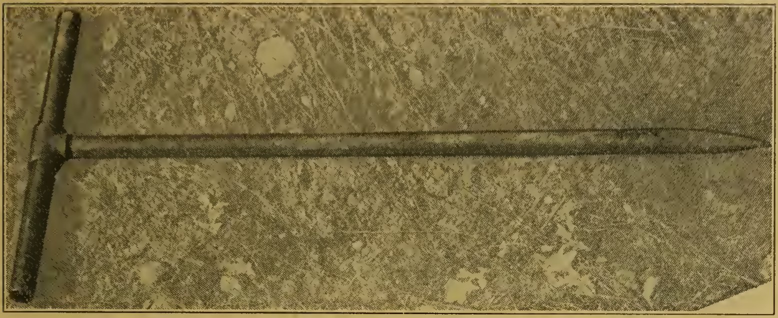
An Auger Works Well for Deep Holes

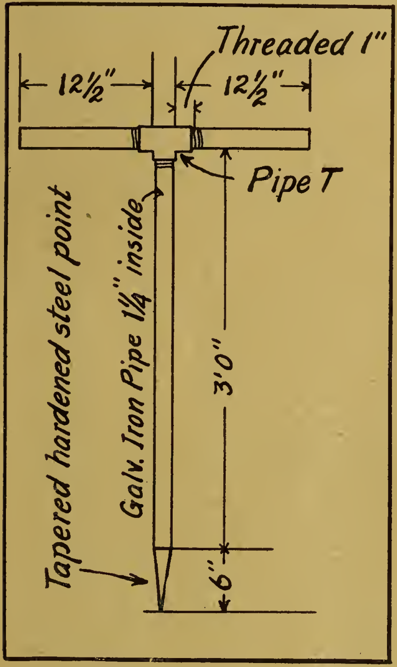
Augers can be purchased or made locally. Weld a 2-inch ship auger to a ⅝-inch iron rod to make a length of about 5 feet. Weld a cross bar for handle.

A ⅜-inch or ½-inch pipe welded to a 2-inch ship auger also works well. A regular pipe T and pipe nipples for cross handles can be attached easily. For deep holes and in some stiff clays, an auger works well.

Use Only a Wooden Tamp Stick

Use nothing but a wooden tamping stick. A long handled shovel handle is good although any smooth long stick will do. There is a good hand hold on the shovel handle when used as a tamp stick. Iron or metal bars should not be used for tamping.





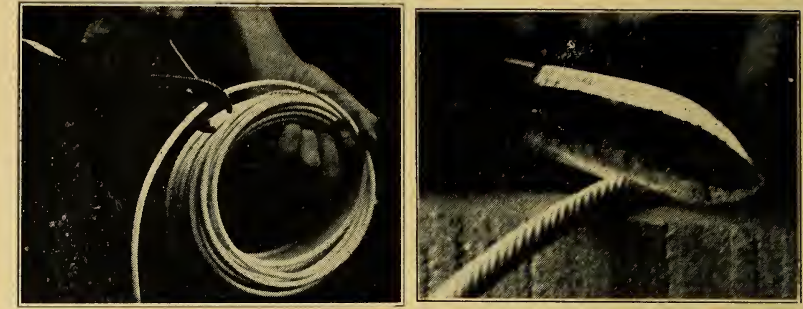
The Punch Bar is Made Easily and Works Well

In soft soils and for ditching the so-called punch bar is handy. It can be made of pipe fittings.

CAP AND FUSE BLASTING

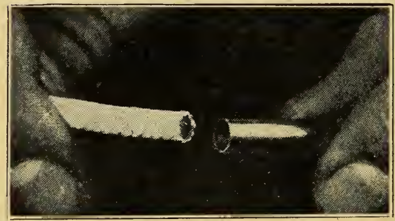
Careless and inefficient use of cap and fuse is responsible for most accidents with explosives. These materials are usually very uniform and when properly used give good results.

Priming consists of placing the electric cap and fuse or the electric blasting cap in the charge of dynamite. This is usually done with one cartridge. Two common and efficient methods are mentioned. Most other methods are objectionable and often dangerous.



Sharp Tools Mean Good Work

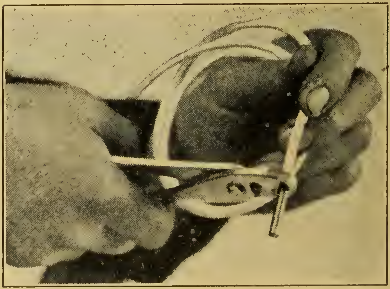
Cut the fuse squarely with the fuse cutter on cap crimper or with a sharp knife. Trim off an inch or so at the end and throw this away as the end may have become damaged or wet. Ragged edges left by dull knife will be hard to put in cap and may prevent firing.



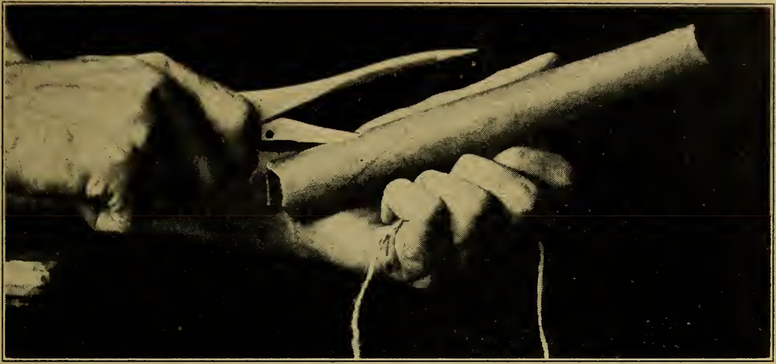
Fuse Goes In Easily

Fuse cut off squarely is easily inserted in the cap until it touches the charge. Fuse should not be twisted or forced into the cap.

Carefully secure cap to fuse with a cap crimper made for that purpose. This is safe and gives better results. Pinchers, pliers, jack knives or other makeshifts are inefficient and unsafe. Crimping caps on fuse with the teeth is exceedingly dangerous and makes a poor crimp.

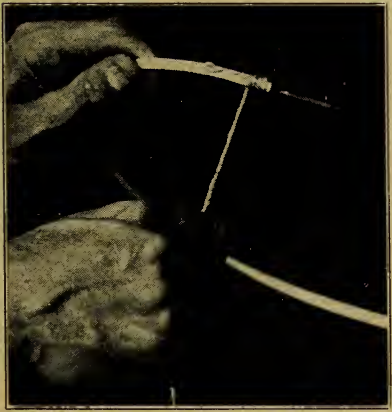


Accidents Are the Penalty of Bad Crimping



Cap Should Lie Lengthwise

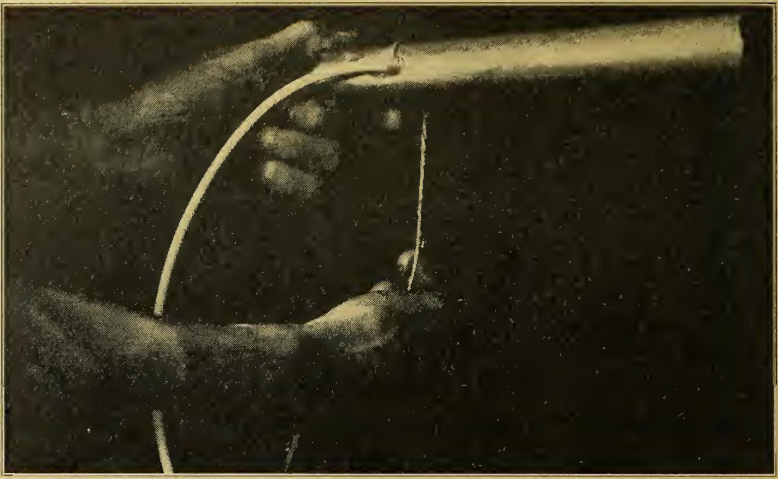
Make hole in the side of the cartridge with the handle of cap crimper so that cap will lie lengthwise of the cartridge. Soften the cartridge if necessary by rolling between the hands. The handle of the crimper is safe to use with explosives now sold. It is made for that purpose.



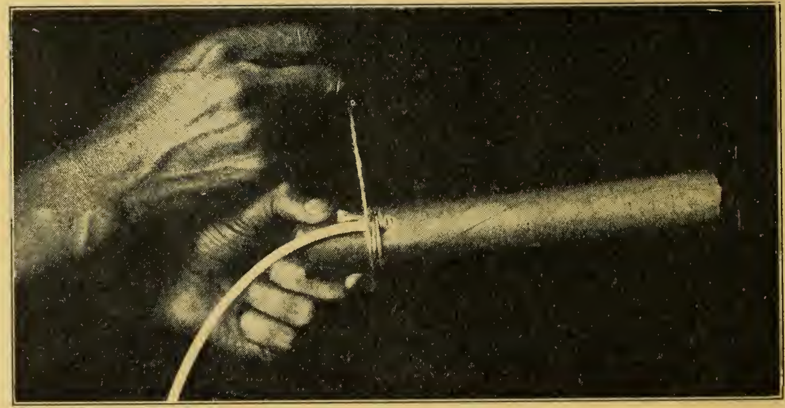
A Primer Without Knots

To fasten cap and fuse to cartridge, first make four or five wraps with a coarse string about 20 inches long, around fuse a little above the cap. These wraps should cover the end of string so as to grip tightly.*

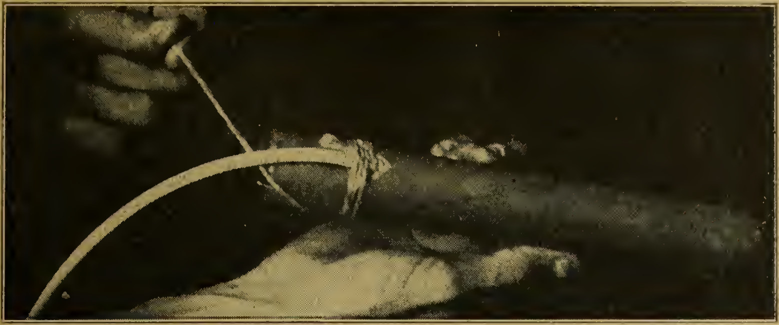
This method of fastening was suggested by A. H. Wright of the Wisconsin College of Agriculture.



Insert Cap and Fuse with String Attached

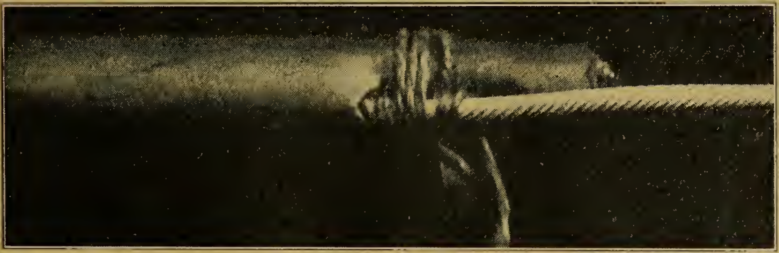


Wrap String Tight



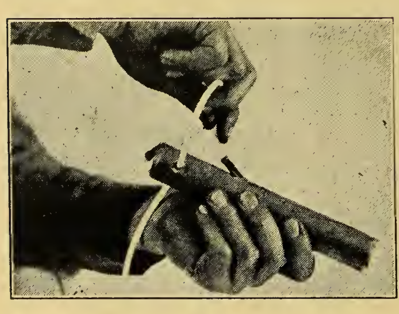
Tuck End of String Under Fuse

Next wrap the loose end of string around both cartridge and fuse above cap three or four times finally drawing the end under between fuse and cartridge. Draw the string tight. An extra turn about the fuse will help hold the end more securely.



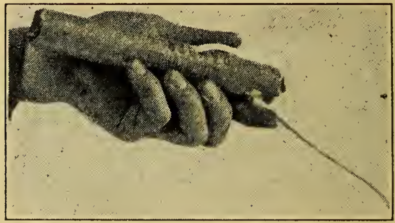
This Primer is Efficient and Safe

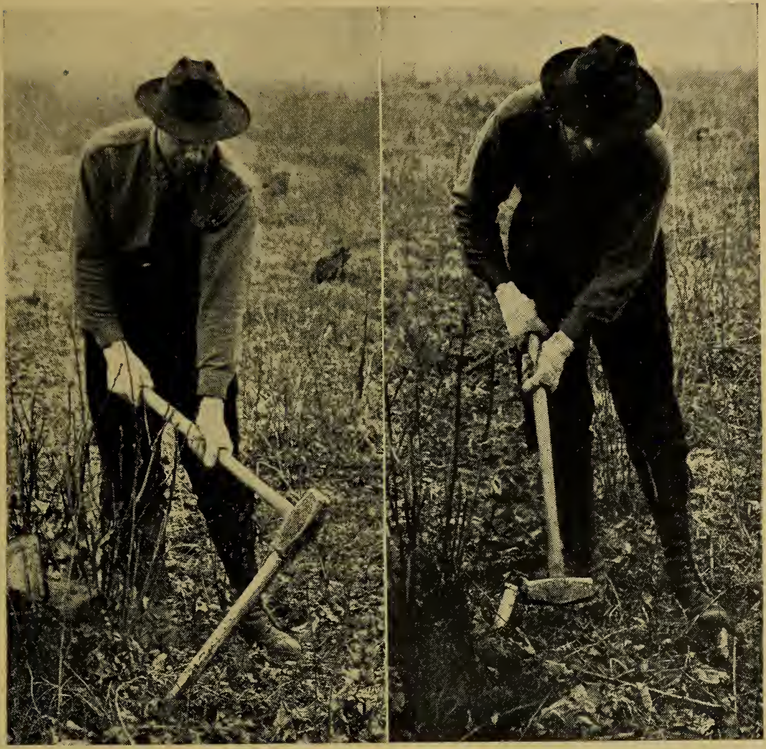
It is easily made and adapted to all kinds of explosives. It can be made in cold weather with gloves on. Strings can be cut in advance; and almost any kind will do. The cap is embedded in explosive and will not be moved out of position in tamping and is not likely to strike any rock in the borehole.



Lacing Requires Care and Good Fuse

Lacing fuse through cartridge to make the primer is often done and is a practical method with many explosives. Fuse must be of good grade. It must not be cold; and sharp bends must be avoided as far as possible. While this method has the advantage of requiring no strings, it requires care in making and should not be used with inflammable explosives.





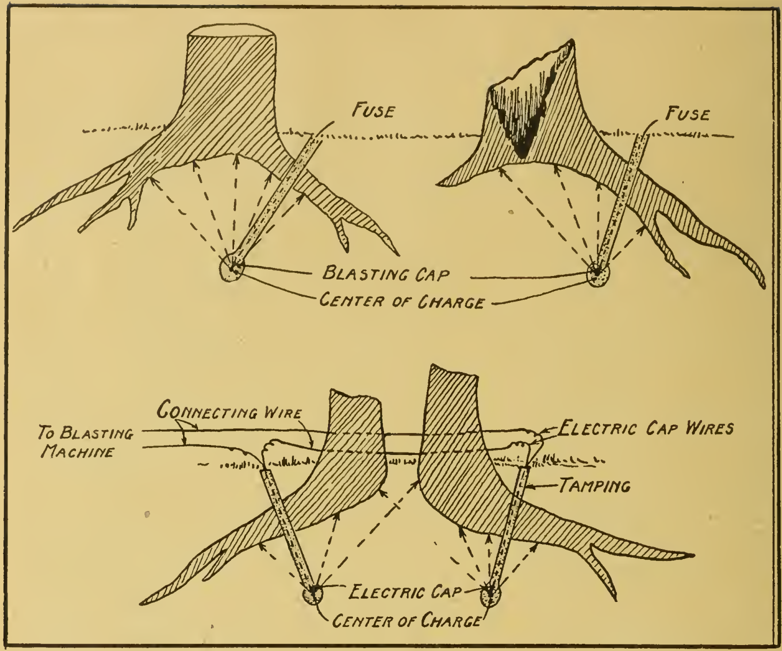
Make Borehole Well Under Stump

The hole made for loading explosives is called a borehole.

The effectiveness of explosives depends on the confinement of the charge so that when it explodes it will get a chance to lift on the holding part of the stump. Explosives act equally in all directions but the main force of the explosion escapes in the direction of least resistance. This means that the location of the charge is of utmost importance to get good results with the smallest quantity of material.

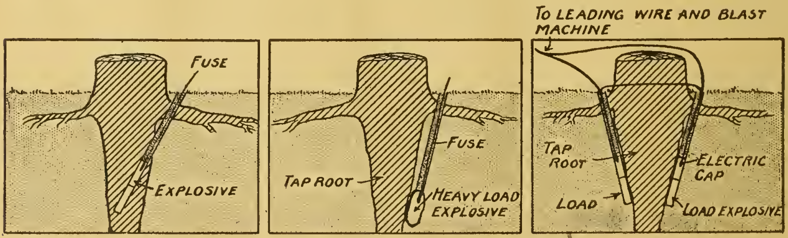
The borehole can be made easily with the driving bar to place charge in proper place. Drive the bar with the 10-pound double face blacksmith sledge. Batter bar on sides as it is driven down and it will be loose and easier to remove. Pounding on the sides will loosen it after it is deep enough. This also slightly enlarges the hole. It can then be easily pulled out in practically any soil condition.

If the bar is caught against a root or other obstruction, a short chain and crowbar may be used to pull it out. Boreholes should always be well under the center of the holding part of the stump.



Lift Where it Holds

Place the center of the charge of explosive directly underneath the holding part of the stump. If a stump has a uniform root system, the charge can be placed under the center. If the stump is more firmly rooted on one side, then the explosive should be placed nearer that side. If a large stump is hollow, two or more charges fired electrically may be best.



Tap Roots Require Different Loading

It is impossible to get one charge under the center of a taprooted stump except with a boring outfit to bore into the tap root. Either place a large load close against the tap root so as to cut it off and release stump or place two charges, one against the tap root under each side and fire them electrically.

Put Explosive Where It Can Work

Push wooden tamp stick down in borehole to locate any obstructions. Then prepare cartridges for loading. Slit each cartridge wrapper with the point of a knife so that the cartridge will pack solidly in the bottom of the hole. The paper wrapper is an explosive. Don't throw it away. Don't waste explosive by pouring it down the hole as it sticks to the sides and becomes mixed with soil. After the cartridge has been slit, pressure with tamp stick breaks it and packs it tightly in the hole, forcing out all air which might act as a cushion.

How Much Explosive

No absolute figure is possible on account of the many different conditions. Trials should be made using tables for suggestions.

TABLE I.—QUANTITY EXPLOSIVE NEEDED FOR HARDWOOD STUMPS (MOIST SOIL)

Diameter, 1 foot above ground.	Age	Cartridges Explosive
6″ 6″	Green 2—3 yr.	1—2 ½—1
12″ 12″	Green 3—4 yr.	3—4 1—2
18″ 18″	Green 4—5 yr.	5—7 2—3
24″ 24″	Green 5—6 yr.	7—8 3—4
30″ 30″	Green 6—7 yr.	10—up 4—up

TABLE II—QUANTITY EXPLOSIVE NEEDED FOR WHITE PINE

Old but Solid Stumps (Soil Moist)

Diameter, 1 foot above ground.	Kind of Soil	Cartridges Explosive
18″	Heavy Light	2—3 3—4
24″	Heavy Light	3—4 4—6
30″	Heavy Light	5—6 6—10
36″	Heavy Light	7—8 10—15
42″	Heavy Light	10—12 15—up

In dry or sandy soil, these quantities will be increased 50 per cent or even more.

Age of stumps is calculated from time the tree was cut.

Explosive cartridges are to be equivalent of ordinary 40 per cent dynamite.

Large green stumps are seldom blasted economically.

Hardwoods seldom grow on light soils. Pine grows on all soils.

Oak, basswood, hickory, elm and occasionally others require special treatment with maximum quantities of explosive.

Be Careful With Primer

Put in the primed cartridge or primer last. Do not slit the primer. To do so might caûse the cap to be misplaced or removed. The cap should be kept pointed toward the main part of the charge. Press the primed cartridge down firmly but avoid jarring.

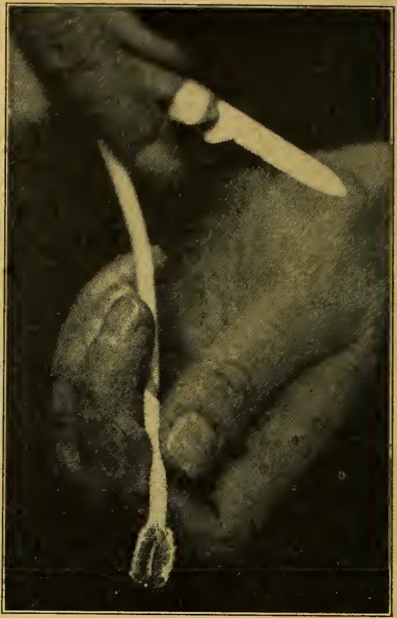
Good Tamping Saves Explosive

Put two or three inches of moist earth, preferably clay, on top of the primer. Press this down carefully. Then tamp the hole full of moist earth. Sod, leaves or dry sand are not good. Put in a little at a time and tamp well but keep small stones or pebbles out of the hole. Thorough tamping prevents escape of gases out of the borehole. Careless tamping is one of the most common sources of loss among explosive users. In dry or sandy soils, water with the tamping will help.

Use explosive on stumps when soil is wet.
In spring when soil is wet, one pound of explosive will do the work of 1½ to 2 pounds used when soil is dry.
Explosive can be used in fall after heavy rains.

Slit end of fuse for lighting. Slit should be made one-half way through on upper side so powder cannot fall out. Many accidents are traceable to carelessness or failure to prepare fuse for lighting. A properly prepared fuse saves time and is sure to light. Use enough fuse. Do not take chances to save a part of a cent.

When ready to light fuse, look about the field. Be sure everyone is out of danger. Tools should be out of the way. Dynamite and caps should be carried out of range. Caps should not be left where a falling rock might strike them.

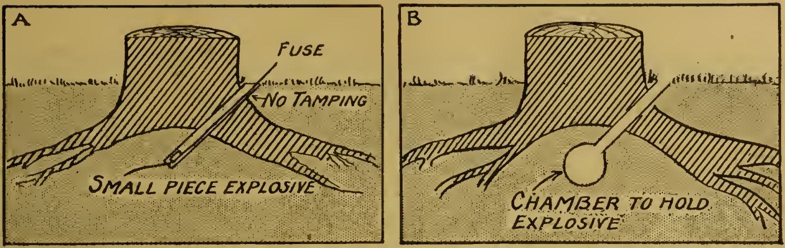


Prepare Fuse Properly. It Lights Easier and More Surely

Don't Forget to Call "Fire!" As a Warning

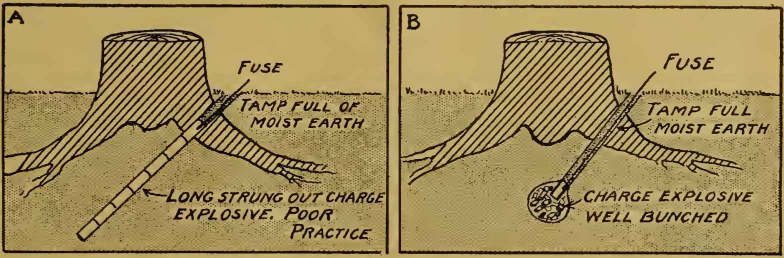
Use a small stone on which to scratch the match and then quickly force the head of the match into the slit end of the fuse just as the match flares up. The melting red hot head of the match fires the powder. Do not try to hold the flame under the end of fuse. The right way is quick and sure. When the powder in the fuse lights there is a spit which can be seen and heard. Be sure fuse is lighted. Fuse should be long enough for the operator to get to a safe distance. Avoid getting under trees. Out in the open a man can dodge stone and roots.

Light Fuse with Head of Match



Spring a Chamber for the Charge

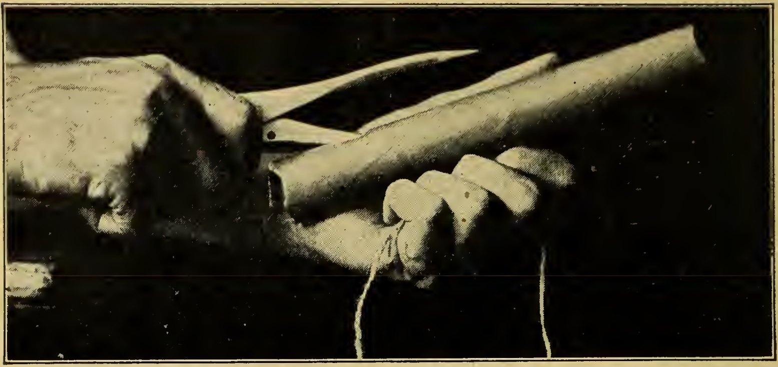
On large stumps where large loads are needed and an electric outfit is not available, a larger hole must be made to hold enough explosive. Make a hole as deep as needed to locate the charge properly under center of stump. Use a small piece of explosive one to three inches of the end of a cartridge, depending on size of hole needed and kind of soil. Tie cap and fuse in this and place in bottom of borehole. (A) No tamping is used in this case. The primer is then fired. The result is a small chamber. (B) It may be necessary to push bar down to open up the hole as small lumps of soil may be in the way. Leave hole stand for a short time to cool before loading with explosive. Place slit cartridges in the cavity. Pack tightly, being sure the primed cartridge placed last is in contact with the rest of the charge and that soil is not mixed between cartridges. Then tamp full of moist soil and fire.


A
FUSE
TAMP FULL OF MOIST EARTH
LONG STRUNG OUT CHARGE EXPLOSIVE. POOR PRACTICE
B
FUSE
TAMP FULL MOIST EARTH
CHARGE EXPLOSIVE WELL BUNCHED

Long Narrow Charges Waste Explosive

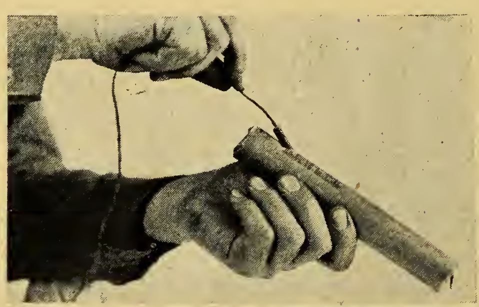
Charges should be bunched as much as possible to get the best effect with the least explosive. (B) Other things being equal, a charge bunched together will do more work than the same charge strung out in a narrow hole. (A)

ELECTRIC BLASTING

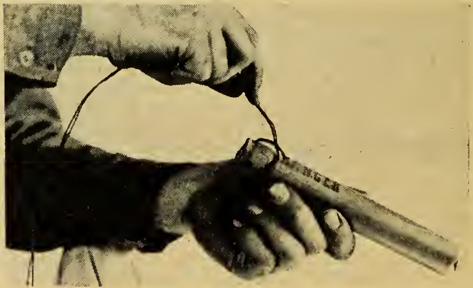


Make Hole for Cap

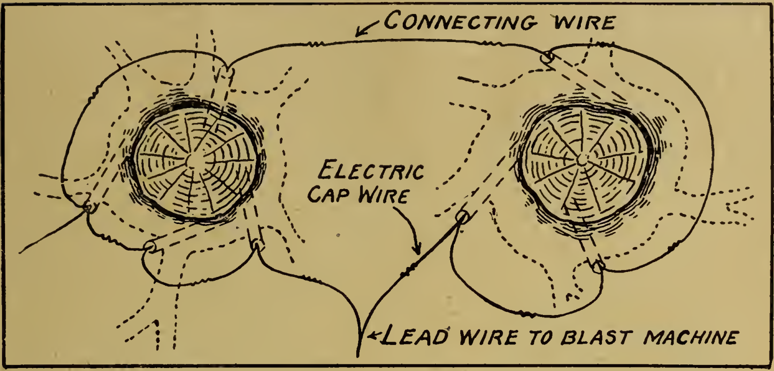
Make a hole in cartridge on side near one end so that the cap will be lengthwise of the cartridge.



Insert cap in hole and make a half hitch about end of cartridge and draw tight. This primer is easily made, practical and efficient. Do not let cap wires become damaged. In loading, slit first cartridges the same as in cap and fuse blasting. Put in primed cartridge (without slitting) last and tamp hole full of moist earth. Care should be taken to hold the ends of the wires when tamping.



Make the Primer This Way



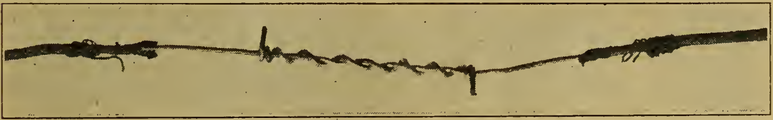
Put a Charge Under Each Root

Several charges either under one large stump or under several stumps may be fired at the same time with the electric blasting method.

Connect one of the cap wires to one of the wires of the next cap and so on until loaded caps are connected into the series. The last two wires are then connected to the leading wire. (Be sure blasting machine or batteries have been previously disconnected.)

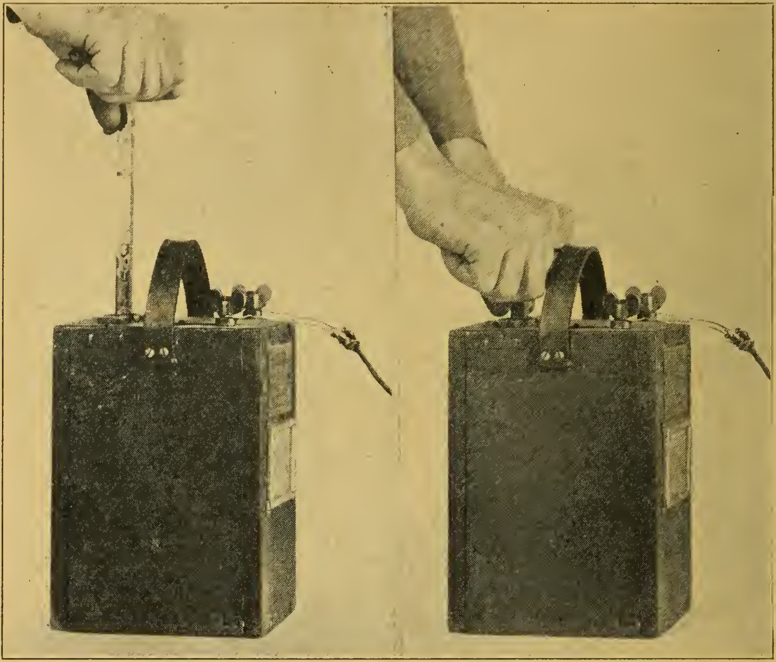
Connecting Wires Should Be Clean

Before using connecting wires, have them clean and bright. Scrape off insulation and wind wires tightly together to make a good electrical connection. If the separate charges are too far apart, additional wire will be needed to make connections. It is called connecting wire. Old cap wires are often picked up about the field after electric blasts have been made. They may be used for short connections but the insulation should be well cleaned off at the ends and care should be taken to detect possible breaks in the wire under insulation.



The same care needs to be taken to insure a tight clean electrical connection of the cap wires or connecting wire to the lead wire.

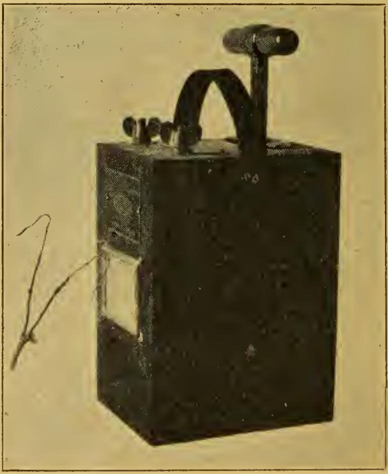
Before connecting up, look around the field to see that every one and everything is out of danger. Caps should not be left where a falling rock or other object might strike them. *Then call "fire!"* loudly, as a warning. Connect the two wires of the leading wire to the binding posts of the blasting machine and then if everything is ready, push down handle. Watch for flying stones, roots, etc.



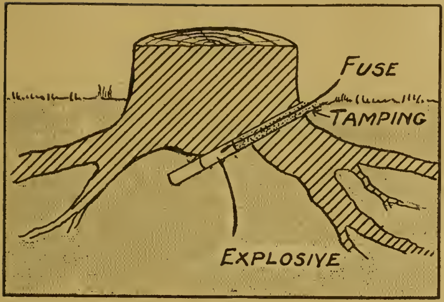
Raise lever as far as it will go. Firmly push down lever, striking the bottom hard.

Disconnect Leading Wire from Machine

While machine does not hold current when not operated, it is safer if wires are disconnected each time.



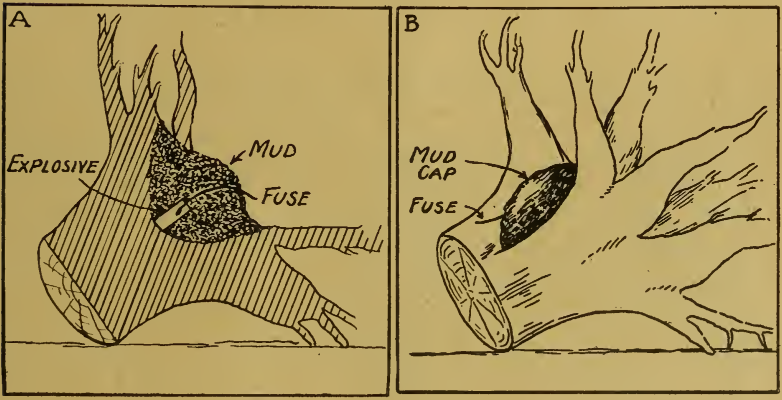
CRACKING STUMPS



Load Shallow for Cracking

Large stumps often need small charges of dynamite before pulling to split wood and shake roots so that pulling is easier, soil is left in the hole, and pieces can be handled. Place a small charge of high-grade dynamite close under center of wood part of stump between the roots. A trial will indicate quantity required. This is usually one-third or one-half of what is needed for complete removal. A higher grade quicker acting explosive is usually best for this job although low grades will work.

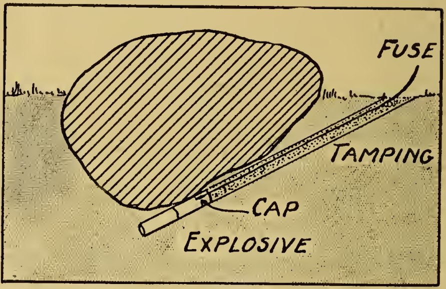
CRACKING PULLED OR LOOSE STUMPS



Mud Cap in Stump

Load close to solid wood in bottom part of the stump. (A) If on the side, a crotch between two roots will often be good place. (B) Use plenty of mud or moist soil to cover the explosive. (See pages 28-29 for mud capping.)

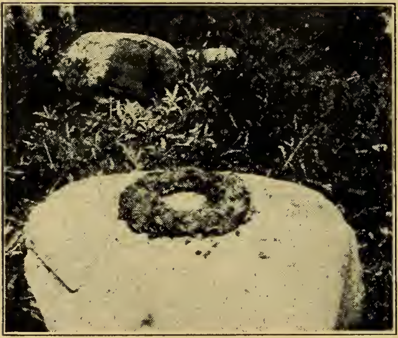
SNAKE HOLING ROCKS



This Lifts the Stone Out

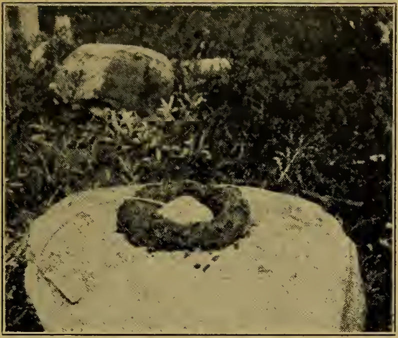
The snake hole method of loading is generally used to lift boulders out of the ground although if a sufficiently large charge is placed tight against under surface of rock, it may be broken in pieces as it is thrown out. If it is not intended to break the rock with this method, a low-grade, slow acting explosive may be used. As a rule, an explosive having a high shattering effect (equivalent of not less than 40 per cent although 50 per cent is better,) is best for rock work. About 3 to 4 cartridges per cubic yard are needed to lift boulders out of the ground if the top is exposed.

MUD CAPPING ROCKS



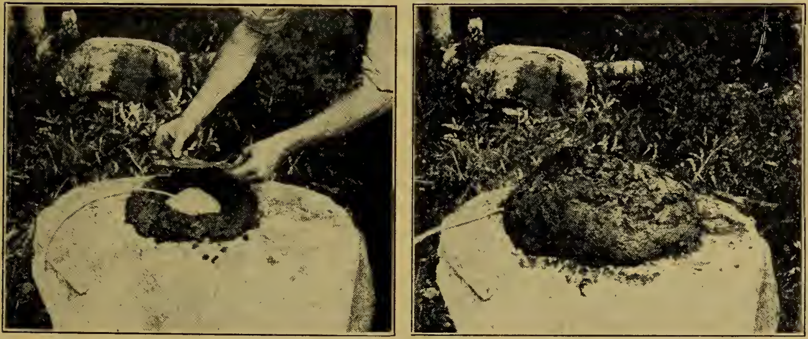
A Ring of Mud Holds Load

The mud cap method is not effective on rock more than 4 or 5 feet thick unless several charges are fired together by electric method. Select, if possible, a depression or hollow to place charge or select a weak place or seam. Often this is the place we would strike if we wished to break with a stone hammer. Use high grade 50 or 60 per cent dynamite. Picric acid or TNT is good. Use the stiffest mud available.



Place the explosive (about 4 or 5 cartridges per cubic yard is a good estimate on Wisconsin boulders) in the pocket. Either slit the cartridges so they can be packed down solid or take the explosive out of wrapper and place tightly against the rock. Use wrappers to cover explosive. Insert electric cap or cap and fuse in the charge.

Pack Explosive Tight

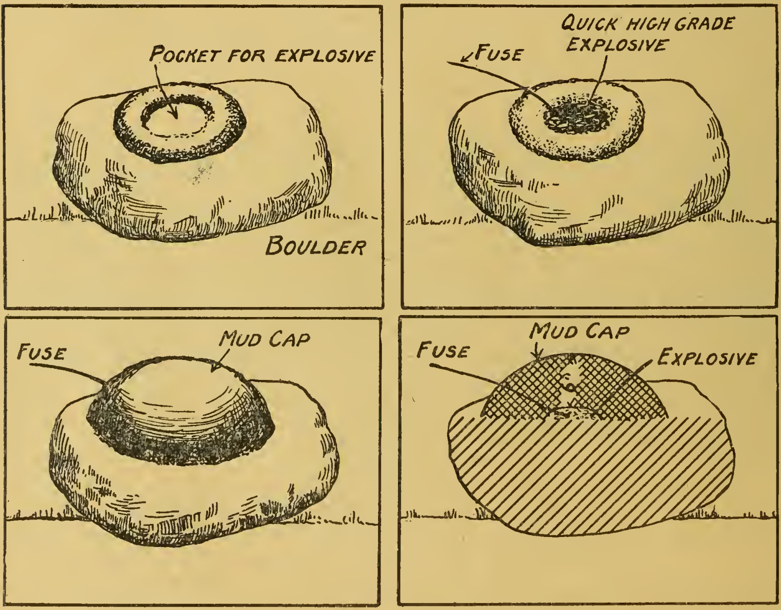


Mud is Cheaper Than Explosive

Cover charge with plenty of mud. Keep out stones or pebbles which might be thrown by the explosion. Pack mud tightly. Heavy sticky clay is best. All air around charge should be excluded.

Pieces Can be Handled

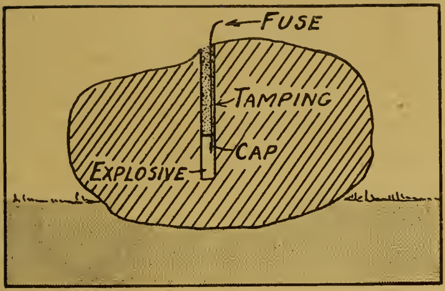
In firing, be sure that everything is out of range of flying pieces, particularly if loads are on the side. The rock is broken into pieces which can be handled. Loads can be increased or reduced as needed after a trial shot.



Proper Locations for Charge

If proper location for the charge is on the side, a base can be easily built to hold the mud cap.

BLOCK HOLING ROCKS



Drill Hole in Boulder

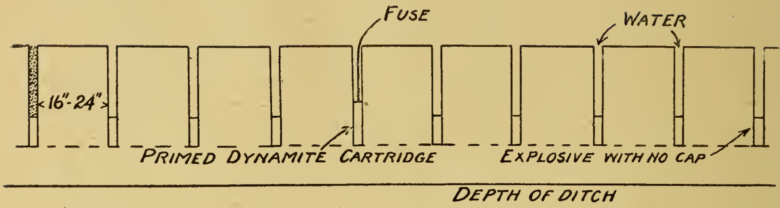
This method requires considerable labor in drilling but much less explosive. It can be used on rocks which are too thick for mud-capping. Cap and fuse or electric method is used but care must be taken to avoid jamming the cap against side of hole. Moist clay should be used for tamping. Only trials will determine the time and material needed as rock conditions vary. About one-sixth or less as much explosive is needed in this method as compared with mud-capping on ordinary sized boulders. It is the best method on rock ledges or very large boulders.

DITCH BLASTING

Explosives Work Well in Ditching

Some kinds of open ditches can be easily and often more cheaply made with explosives.

For straightening out small meandering streams, for making ditches along roads, particularly where roots, stumps, rocks or other obstructions prevent other methods, explosive will be found effective. If a large ditch job is planned, a specialist should be secured. Call on the county agent if much ditch work is to be done.



Propagated Method Saves Caps

In propagated blasting one cap is used to set off a number of charges placed along the line of the proposed ditch. The impulse of the one explosion is carried through the wet soil and sets off the sensitive dynamite charge next to it.

How to Succeed With Propagated Method

Very sensitive so-called "straight nitro glycerin" dynamites of 50 or 60 per cent grade must be used. Low grade dynamites or common stump dynamites, TNT or picric acid will not work. They are too insensitive.

Soil must be wet so that water will stand in the bore holes.

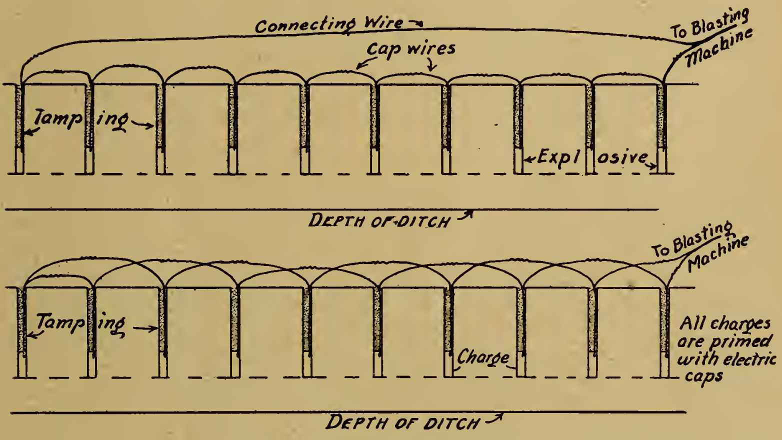
Soil or water must be reasonably warm—not colder than 45 or 50 degrees.

Holes should be spaced according to soil and size of ditch. Usually the load is placed about 6 inches shallower than the depth of the ditch desired. The punch bar is usually a good tool to make holes.

Cut notch to mark tamp stick to get depth right. Make a few trial shots of four or five loads each to determine depth, spacing and size of load. For a ditch about 6 feet wide (at top) and 2½ or 3 feet deep, about one cartridge (one-half pound) of 50 per cent straight nitro glycerin dynamite in holes spaced 18 inches apart usually does the work. If the ditch is too deep or too wide, spacing may be increased or less explosive placed in each hole. The distance between charges should seldom be over 24 inches.

In firing these charges a center load in the group is primed. Sometimes a slightly larger load in this hole will help. As only one cap is necessary, cap and fuse is generally used. Being used in water, joints between caps and fuse should be greased or waterproofed and the cartridge and fuse should be carefully greased where the fuse enters the explosive so that water will not leak in. Use heavy grease not oil. Charges should not be left standing long before firing. Soil should be wet so that water stands in holes above the explosive. Tamp the soil in above explosive to help confine the gases and make them work.

ELECTRIC DITCH BLASTING



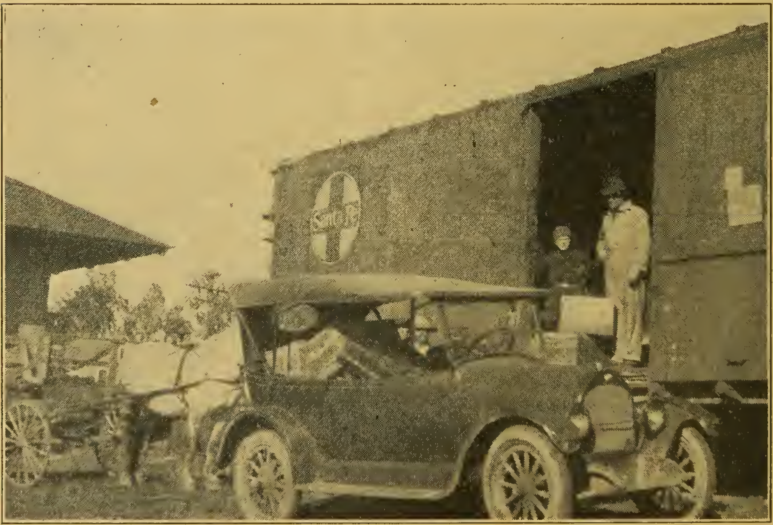
Use an Electric Cap in Each Load

Either method of wiring may be used as conditions demand. The same result will obtain in either case.

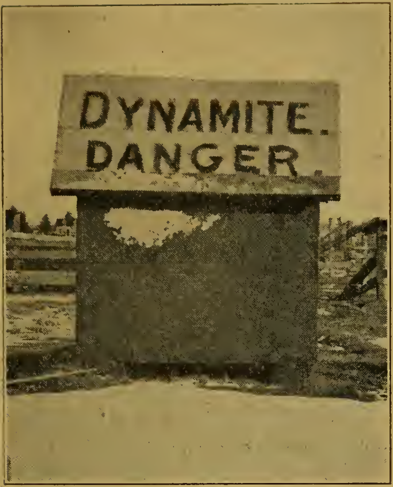
With an electric blasting machine, ditches can be made in almost any kind of soil except dry sand. Insensitive and slower ordinary dynamites can be used and work can be done in cold weather. Holes are spaced farther apart. Trial shots will aid in determining distance, depth and quantity needed. Cartridges are primed as for stump work but if used in water the primer must be waterproofed. Holes should be tamped full to the top.

DISTRIBUTION OF EXPLOSIVES

Wasteful practices in buying explosive for farm use add tremendously to the cost. Not only is the explosive hazard greatly increased but the regulations to prevent accidents are more costly per pound when small quantities are shipped, stored and retailed. Orderly distribution on the basis of community demand was one of the first jobs tackled by the Wisconsin College of Agriculture and cooperators. Pooling of orders and carlot purchases by dealers and car-side distribution has lowered explosive costs to Wisconsin farmers. This method saves from five to ten cents a pound and is possible through intelligent cooperation of farmer with dealer, banker and manufacturer. County agents are usually the local connecting link in this cooperative chain. Farmers can well afford to get their explosive under this plan. To get the benefit, a farmer must figure ahead and order what he will need so that his order can be combined with those of his neighbors. Carlot handling of war explosives effects still larger savings.



Farmers Save One-Third of Cost by Car Lot Handling



Store Explosives and Avoid Danger

A special magazine is seldom available for the small lots of explosive used on farms. Select the best place available. Explosives should be stored in a dry place where air can circulate freely and where irresponsible persons or children cannot tamper with them. There is little danger in storing if ordinary care is taken. Caps should not be stored in the same building with other explosives but should be kept locked up separately.

Caps and fuse, as well as dynamite, will deteriorate if kept in a moist place.

Boxes should not be stored on bare ground.

Primed cartridges should never be stored. Carefully remove caps from cartridges if they are not used before end of day.

Cold does not damage ordinary explosives if they are stored in a dry place.

Farmers can seldom afford to store explosive and have stumps or stone in the field ready for removal. Some explosives lose strength and effectiveness on long storing.

It is better to purchase just enough explosive to meet seasonal needs than to purchase large quantities that must be stored over winter.

HANG FIRES AND MISFIRES

A hang fire is a charge which fails to go off at the proper time when fuse is lighted but later does explode.

A misfire is a charge which is lighted but entirely fails to go off.

The cause is sometimes defective fuse or caps but is usually through carelessness or ignorance of the way the materials act and should be used. Misfires and more especially hang fires are sources of great danger. The man lights his fuse and goes out of danger. If, after waiting a few minutes, the charge does not explode, he goes back to investigate with the charge still hanging fire. This is a very dangerous practice.

Careless handling, bending, breaking, kinking, pinching or wetting may stop the burning of powder for a short distance. It is then possible for fire to smolder and continue to burn in the tar and cotton covering of the fuse until it reaches new powder in the lower end of the fuse, which then starts burning and fires the cap. This cover may hold fire for many hours. A hang fire was observed which finally exploded more than ten hours after lighting when only a short fuse was used.

To Avoid Hang Fires

Prime carefully using approved methods. Study priming pictures.

Use good fuse that has been kept dry.

Avoid bending, pinching, or otherwise damaging fuse.

Use cap crimpers. Pliers, knives, or teeth are likely to crush the fuse and cause hang fires or misfires.

The possibility of a month in the hospital, the loss of an arm or even the loss of life are common disastrous results that justify all possible care and caution.

Do not investigate hang fires until next day. By that time they will be misfires.

Avoid removing a misfire by placing a second charge as this may only throw unexploded cap out in field where it may be walked on or otherwise be accidentally set off.

Take Plenty of Time

To remove misfire, carefully dig out charge following fuse and gradually work soil away with hands or piece of wood until charge is reached. This should be done very carefully, however, taking plenty of time to avoid explosion of the cap by friction or impact. The charge can then be removed, or if the explosive is still dry a new carefully primed cartridge can be put in hole tamped full and load fired.

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Circular 165 February, 1924

Tuberculosis of Domestic Animals

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31 1924

EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN, MADISON

Have Your Animals Tuberculosis?

Tuberculosis is one of the most important contagious diseases of cattle, swine and poultry.

* * * *

It receives its name from the tubercles or nodules that develop in the diseased organs, most frequently in the lungs and lymph glands.

* * * *

The germs of the disease are given off in the sputum, the manure, or the milk, and are taken in by the healthy animal in breathing or in eating and drinking.

* * * *

Tuberculosis is introduced into the herd and flocks by purchase of diseased animals, or by feeding mixed raw skimmilk or whey. Bad sanitary conditions favor the spread of the disease in the herd.

* * * *

Tuberculous animals show no symptoms until the disease is far advanced.

* * * *

The use of milk from tuberculous cattle causes a portion of tuberculosis in man.

* * * *

The introduction of the disease into the herd can be prevented by the use of creamery and cheese factory by-products only after they have been heated, and by the determination of the condition of purchased animals.

* * * *

Tuberculosis can be detected with a high degree of accuracy by the use of the tuberculin test.

* * * *

Tuberculosis can be controlled, if animals found by the use of the tuberculin test to be tuberculous are taken from the herd and every possible effort is made to keep the disease from gaining headway.

* * * *

The state and federal governments are expending large sums in helping the farmers solve the problem of tuberculosis. Federal and state aid cannot be continued indefinitely.

Tuberculosis of the Domestic Animals

E. G. Hastings

TUBERCULOSIS is a world-wide menace to cattle, hogs and poultry. It is the most important disease of cattle in the northern part of the United States; and federal authorities estimate that it places an annual tax of $40,000,000 on the industry. Hog tuberculosis seems to be most prevalent in the cheese- and butter-producing districts. Poultry tuberculosis was not known in Wisconsin before 1905, but at present thousands of flocks are diseased.

Besides the financial losses due to tuberculosis in domestic animals, it may be a grave danger to human health as well. It is not believed that adults acquire tuberculosis from infected meat and milk, but the data gathered in portions of the world in which bovine tuberculosis is widespread show that it is responsible for about 10 per cent of the deaths due to tuberculosis among children under five years of age, and also for many cases of tuberculosis which do not end fatally but often leave their victims permanently scarred and crippled.

Introducing the disease into a herd can be prevented by buying only healthy animals and by heating all creamery and cheese factory by-products before they are used. Tuberculosis can be controlled if diseased animals are taken from the herd and if other necessary precautions are taken.

What is tuberculosis? It is a transmissible disease, caused by a certain kind of bacteria which, when growing in the various organs, produce characteristic nodules or tubercles from which the disease is named.

What is a transmissible disease? One in which the causal factor can be carried from a diseased individual to a healthy one. Transmissible diseases are most important because the causal organism may reach such a great number of susceptible plants or animals.

Bacteria are the chief causal agents of transmissible diseases. In nearly all cases the organism can grow only on or in the body of the plant or animal so that the organism must pass from the individual in which it grew to another in which it will find fresh food. Sometimes its path can be traced easily; again, the connection between the diseased animals is not clear. This, together with the fact that the causal organism cannot be seen, tends to produce mistaken ideas about transmissible diseases. The appearance of such a disease in the herd is no more mysterious than a new weed in the pasture. The organisms producing the trouble have come from their previous place of growth, just as the seed of the plant has come from the place of growth of the plant which produced it.

What other names are applied to tuberculosis? Grapes and pearl disease are names given by the butcher to certain types of the disease in cattle. In poultry the disease is often called "going light," "spotted liver" and rheumatism.

What animals have tuberculosis? All warm-blooded and some cold-blooded animals. Cattle, hogs and poultry, acquire the disease most readily. Sheep, horses, dogs and cats are seldom affected.

Where is tuberculosis found? It is world-wide in man and practically so in cattle, hogs and poultry. The most important of the dairy and beef breeds of cattle were developed in northwestern Europe. They were sent to all parts of the world and some of these animals carried the tubercle organisms into regions where the disease was unknown. This is proven by the freedom of the native cattle of many countries from tuberculosis and its appearance among them after the coming of pure-bred cattle.

To what extent does tuberculosis occur? The extent of tuberculosis among domestic animals varies widely in different countries and even in various parts of the same country. Over 50 per cent of the adult cattle in certain German states are tuberculous. At least 25 per cent of the milk cows of the eastern part of our country are affected, and the same is true of limited areas in the central states. In the south and west, probably less than one per cent of the cattle are diseased. In Wisconsin the disease is more prevalent in the southern and eastern parts of the state.

The extent of hog tuberculosis is less well known since most of the facts are gained by post-mortem examination of carcasses at the large packing centers to which hogs are shipped from widely scattered areas. One-third of the hogs from certain areas are tuberculous, while from other places the percentage is very small. In general the disease compares in its occurrence with bovine tuberculosis to which it is supposed it owes its origin.

Tuberculosis of poultry is found in all parts of this country and probably is as extensive in the newer regions as in the older. Its distribution is not related to bovine tuberculosis.

What determines the extent of tuberculosis? The extent to which a noxious weed is found in any area depends on how long a period since it was introduced; the opportunity it has had to spread from farm to farm through the exchange of grain and grass seeds; and on the efforts made to check it. The same factors apply in tuberculosis. Time, opportunity to spread, and lack of effort to control it result in its general occurrence.

The extent of the infection in cattle is greatest in districts where cattle raising has been long established and especially where there has been much buying and selling of cattle. The farmers of the fluid milk districts sell the dry cows and replace them with fresh milking animals so that the herds are constantly changing. The fluid milk areas of the eastern states and of Illinois and Wisconsin show high percentages of tuberculosis as compared with the dairy manufacturing areas in the same states.

The same difference is true in herds. The herd maintained by its own progeny is far less likely to be tuberculous than one constantly changing through sale and purchase.

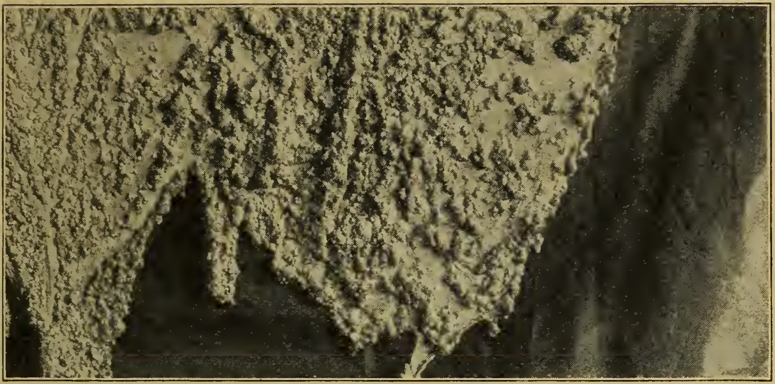

FIG. 1.—A TUBERCULOUS OMENTUM.

The membrane covering the stomach and intestines is normally smooth. This specimen from an advanced case shows the membrane studded with masses of small tubercles. The term "grapes" is often applied to this condition.

Hog tuberculosis is apparently most prevalent in the cheese- and butter-producing districts. Tuberculosis of poultry depends on the extent of change in flocks by purchase and the time during which such change has been going on.

Are some breeds more susceptible than others? Rugged-appearing beef cattle acquire tuberculosis just as readily as dairy animals. Cattle of any breed, beef or dairy, acquire tuberculosis easily and quickly when brought in contact with diseased animals giving off the tubercle bacilli. There is no reason to believe that the various breeds of hogs and poultry differ in susceptibility.

What is the economic importance of tuberculosis? It is difficult to estimate the loss caused by tuberculosis for its effects are often intangible. The losses are due to decreased productive power of cows and hens, condemnation of meat in the packing houses, and death of animals. There is a tendency for the farmers to sell unthrifty cattle for slaughter, which makes it impossible to estimate the death rate due to tuberculosis.

The Idaho station has published data showing the marked influence of tuberculosis on the death rate and productivity of hens. In 89 infected flocks containing 5,147 adult birds, 1,507 or 29.3 per cent died of the disease during the spring and summer. A comparison of the egg production showed that 26.2 per cent of the healthy birds laid daily, while but 8.2 per cent of the tuberculous ones did so.

What is the human significance of tuberculosis of domestic animals? Beyond all doubt tubercle bacilli from cattle are able to cause the disease in human beings. If infected foods, such as meat and milk are eaten raw, there is opportunity for infection. It is not believed that adults acquire tuberculosis from such food, but children often do. The percentage of tuberculosis in children due to infection from milk and its products will vary depending on the amount of the disease in cattle in the district from which the milk comes.

Tuberculosis of poultry probably has no sanitary significance because the organism is unable to infect man. There is little danger from meat as tuberculosis usually does not affect the muscles, and besides the heat of cooking destroys the tubercle bacillus. The danger of infection from milk is far greater because it is often used raw and because it is much more important in the diet of children. Milk also is more likely to be contaminated with the tubercle bacillus than is meat.

What parts of the body are most likely to be affected? In cattle the lymph glands of the neck and lungs are most often affected. The lymph glands of the neck and of the intestines of hogs are much more likely to be diseased than any other part, while in poultry the liver, spleen and intestines are most commonly invaded by the disease.

What other parts of the body may be affected? The lymph glands in all parts of the body may be diseased, even those in the muscles. The brain and spinal cord are sometimes affected as are the bones, joints and skin. Tuberculosis is sometimes found in the reproductive organs. The udder is affected in about 2 per cent of tuberculous cows. The disease may be in parts of the body not usually examined, and it may be present in any part, hence, it is very difficult and often impossible to say from an ordinary post-mortem examination that an animal that has reacted to tuberculin is actually free from the disease and that the tuberculin test is in error. Apparently healthy tissues can sometimes be shown to be tuberculous by microscopical examination.

What changes occur in the size of tuberculous organs? The common name for tuberculosis in man is consumption. This has led many to believe that diseased organs are shriveled or shrunken, as if consumed by the disease. The opposite, however, is the case. Under the stimulus of the organism new tissue is formed much as galls develop on leaves due to the bites or stings of insects. In many cases the organs may be many times larger than normally. The liver of one hen examined weighed over one-half pound and nearly filled the abdominal cavity. Enlarged lymph glands in cattle are common.

Why is the disease called tuberculosis? The name is derived from the characteristic bunches or swellings known as tubercles which are invariably found in diseased animals.

If the tubercles are within an organ, they are firm masses quite sharply differentiated from the normal tissue. If near the surface, they look like low rounded swellings.

What is the internal appearance of the tubercles? The inside of small tubercles presents a uniform, gray color. As they increase in size, a small, yellow area, which slowly enlarges, develops in the center. The large tubercles may be hard and gritty, owing to the deposit of lime salts. When the blade of a knife is drawn across the cut surface of such a tubercle, a scratching sound may be heard. The tubercles increase in size and grow together forming large masses of dead tissue which is either hard and dense, or cheesy or semi-liquid in consistency. The pus filling such cavities contains the tubercle bacilli. The tubercles are less evident in the liver, the diseased areas standing out from the healthy tissues chiefly through a change in color.

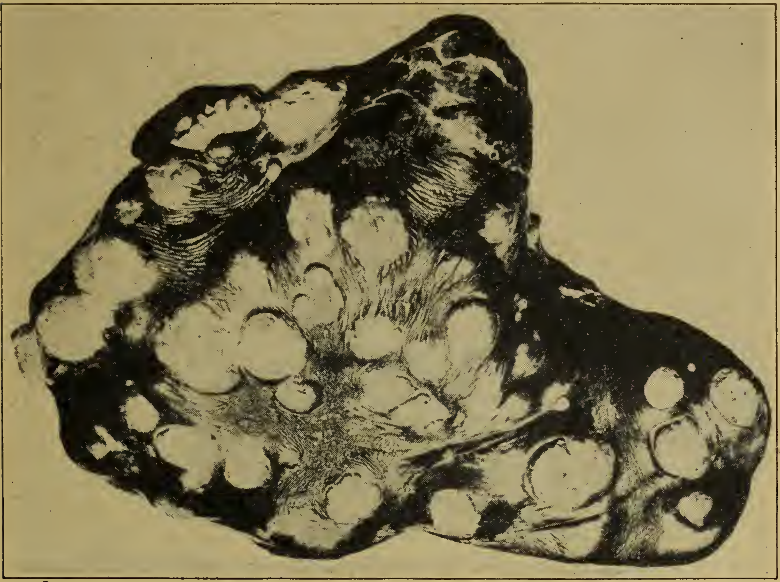

FIG. 2.—A TUBERCULOUS LIVER.

The light colored areas represent abscesses caused by the growth of the tubercle bacillus in the liver from an advanced stage of the disease in a cow.

In birds the liver commonly has bright yellow areas of dead tissue which give rise to the name "spotted liver." Much the same appearance is found in some other diseases of birds. The correct diagnosis can usually be made by finding tubercles in the spleen and intestine.

How does a tuberculous udder appear? The healthy udder is uniformly soft, while the tuberculous udder contains the hard tubercles which can be felt if they are near the surface or if they are large. As the disease progresses, the infected quarter (for the disease is generally confined to one quarter) becomes enlarged and hard. There is, however, no fever or pain; the swelling does not disappear as in the case of garget (inflammation of the udder) but becomes more pronounced. The milk is usually normal but in severe cases is watery.

Why should a post-mortem examination be made on all animals that die on the farm? By making a careful examination of every animal, a transmissible disease may be detected. By proper precautions the spread of the disease often can be prevented.

The person making the examination should remember that a disease may be caused by an organism capable of producing disease in man. The hands should be free from wounds and breaks in the skin. It is advisable to coat them with lard before the examination, which should be made at the place where the carcass is to be disposed of in order not to infect other animals.

How should a carcass be examined for tuberculosis? Study the general appearance of the parts of the body and feel carefully for tubercles. If any suspicious places are found, the organ should be cut. Unless one has made such examinations before, it is advisable to cut the glands and organs even though no suspicious places are found.

The head should be severed as usual and the glands of the throat (cervical) removed, cut open and examined. Cut each gland into several slices and look for yellowish or grayish-yellow areas. A healthy gland is light gray or pinkish in color throughout, but in old animals it is often dark or almost black from pigment.

Remove the udder and examine carefully for bunches (tubercles); also examine the lymph glands just above the hind quarters of the udder.

Open the abdominal cavity. Examine the liver, spleen, and kidneys, first noting their general appearance. If any yellowish areas are found, cut through at this point. Note whether the membrane (the ometum or caul) covering the stomach is smooth and thin or studded with nodules or tubercles.

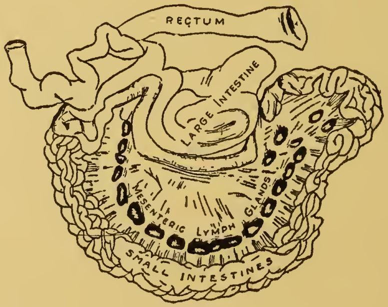

FIG. 3.—LOCATION OF THE INTESTINAL LYMPH GLANDS.

These mesenteric lymph glands are normally about the size of the end of a man's forefinger.

The intestines proper should be examined, although the disease is rarely found on the wall of the intestine itself except in birds. The disease is much more likely to be found in the mesenteric lymph glands, which run parallel to and several inches from the intestines in the membrane that holds the intestines in place. Examine the uterus and the wall of the abdominal cavity. The membrane lining the cavity should be perfectly smooth.

Open the lung cavity and remove the lungs, with the gullet, windpipe, and heart. Healthy lung tissue is uniformly soft and pink in color. Remove the glands on the windpipe, gullet, and especially those at the forks of the windpipe and note whether they are enlarged or not. Cut them open in order to discover small tubercles.

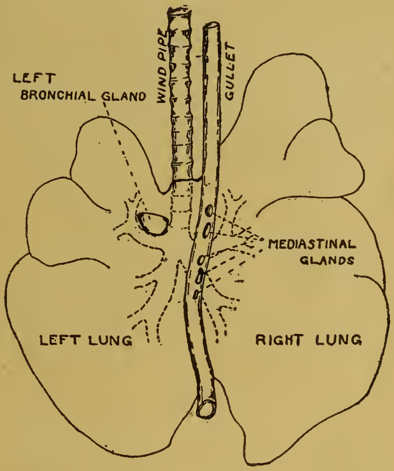

FIG. 4.—LOCATION OF THE LYMPH GLANDS OF THE LUNGS.

The left bronchial gland occurs at the first branch of the windpipe and is just outside the lung tissue. The right bronchial glands are very small or may be absent. The mediastinal glands lie close to the wall of the gullet and are small irregular bodies about one and a half inches in length normally.

If the animal is tuberculous there will usually be signs of it in the parts mentioned, but its non-detection is not positive evidence of the absence of the disease, for in the earlier stages nodules of small size may be overlooked readily.

If the animal has become unthrifty because of tuberculosis, a post-mortem examination is certain to reveal the disease. If the diseased condition of the animal has been indicated by the tuberculin test, it may be difficult or impossible to find evidences of the disease. Such animals are not likely to be slaughtered on the farm.

Does a tuberculous animal show physical signs of the disease? The tubercle bacilli commonly lodge and begin to grow in one or, at most, in a few locations in the body. It requires weeks and often months for the organism to produce any marked effect on the animal. Indeed the primary lesion may break and discharge its contents into the air passages, the milk ducts, or the intestine long before the animal shows any symptoms whatever. This makes the disease especially dangerous since the organisms may be given off in abundance from an animal in apparently perfect health. Sooner or later the infection spreads, due to continued invasion by bacteria from without or to the entrance of the organisms into the blood stream from the original place of growth. The disease slowly becomes apparent and is shown by a general unthrifty condition, rough coat, dull eyes, loss of flesh and sometimes coughing and diarrhea. These symptoms may be caused by so many agencies that they can be classed only as possible indications of tuberculosis.

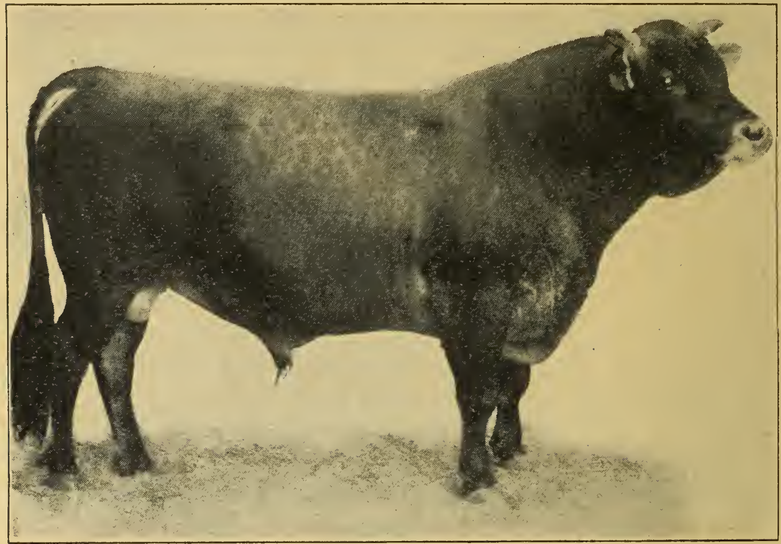

FIG. 5.—APPEARANCES MAY BE DECEPTIVE.

The post-mortem examination of this animal made immediately after this picture was taken showed the presence of tuberculosis in the lymph glands and lungs.

Many cattle owners are certain they can recognize a tuberculous animal by its appearance, but nothing is farther from the truth.

What diseases may be mistaken for tuberculosis? In lumpy jaw (actinomycosis) nodules may be found in the lungs and udder that closely resemble those of tuberculosis. In sheep, the wall of the intestine may be nodular, a condition known as nodular disease or knotty gut, caused by a minute animal parasite that burrows its way into the wall of the intestine.

Johne's disease of cattle is caused by an organism related to the tubercle bacillus. One of the chief symptoms is loss of flesh, a frequent symptom in advanced tuberculosis. The disease can be easily differentiated by a post-mortem examination. The most prominent change in Johne's disease is a thickening of the wall of the small intestine, especially at the junction of the large and small intestines. The diseased wall is often much more wrinkled than normally.

How do the tubercle bacilli leave the body of the diseased animal? The walls of abscesses located in the lungs break and the semi-liquid material with its load of tubercle bacilli enters the air passages, from whence it is coughed up. A small part is expelled from the mouth, soiling mangers and stalls. The major portion of the sputum is swallowed and the tubercle bacilli pass through the digestive tract unharmed to be given off in the manure. Organisms from abscesses in the liver or in the intestinal wall are also eliminated in the feces. From the abscesses of the udder the pus finds its way into the milk ducts.

In avian tuberculosis the organisms are given off chiefly in the dejecta as the tubercles are found primarily on the intestine and in the liver.

What is "closed" tuberculosis? During the early stages of the disease the causal organisms are enclosed in the tubercles and have no opportunity to leave the body. This is known as the "closed" phase of the disease. An animal in this stage is not a source of danger since no organisms can leave the body. It is also possible for the disease to be confined to organs that have no openings to the outside, such as the spleen and lymph glands.

What is "open" tuberculosis? Sooner or later the abscesses found in lungs, liver, intestine or udder break and the harmful material finds its way out of the animal, giving the bacilli a chance to invade another animal. This phase is known as "open" tuberculosis. An animal thus affected is often termed a "spreader."

Does closed tuberculosis change to open? If the disease continues, the closed type is certain to change to the open. The time required for this varies greatly. An animal harmless today may, tomorrow, serve as a source of infection for many others. Every tuberculous animal is a possible source of danger and should be removed from the herd.

Can the tubercle organism grow outside the body of the animal? Since the tubercle bacillus is a parasitic organism living upon the body juices at the temperature of warm-blooded animals, it cannot grow in nature outside the body of animals. However, it is able to remain alive for weeks or months in dirt and manure where it is protected from drying and from sunlight. The bacillus is far more resistant to drying than are most disease-producing bacteria, a fact of importance when cattle and poultry are placed in contaminated stables and yards.

How do the bacteria reach the body of a healthy animal? When the tubercle bacilli have made their way out of the affected animal, there are many ways for them to get into the respiratory or digestive systems of healthy animals. The direct contact of a diseased animal with a healthy one is a most common way of spreading the disease. The tuberculous animal licks herself and thus contaminates her coat with material raised from the lungs or she licks another animal and thus the organism is spread.

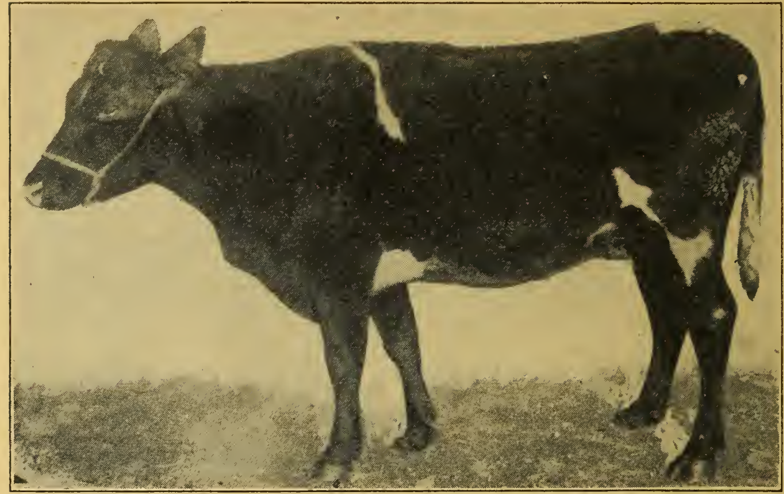

FIG. 6.—AN ADVANCED CASE OF TUBERCULOSIS.

Dull eyes, rough coat, and general debility are often plainly evident in advanced cases.

The mangers, stalls, and watering places are soiled by the sick animal. The material from lungs and from manure finds its way into the air as dust; and again the tubercle bacilli lodge in the throat and invade the lymph glands of the neck. Some are swallowed and pass through the intestinal wall into the mesenteric lymph glands.

Milk from tuberculous udders or that contaminated with manure containing the tubercle bacilli is another means of bringing them in contact with tissues they can invade.

Contaminated food is the chief agent in spreading the organisms among hogs. Milk and its products are responsible for much tuberculosis in hogs. When hogs come in contact with the manure of tuberculous cattle, they are very likely to be infected. Tuberculosis is thus found in the beef-producing districts in which hogs are used to salvage the waste corn in the feed lots.

Poultry becomes infected chiefly through eating the food soiled by diseased birds.

The ways are varied by which the bacilli come in contact with the healthy animal after they have left the body of the diseased. It should be remembered that the organisms can be carried only in the material in which they were contained as they left the body of the diseased animal, for their growth outside the body is impossible.

What favors the spread of tuberculosis in a herd? The rate at which tuberculosis spreads in a herd depends largely on the number of tubercle bacilli present in its environment. One diseased animal may infect a large part of the herd in a few months, but with a larger number of diseased animals in a herd the spread is likely to be more rapid. The general health of the herd influences the rate of spread of tuberculosis. Good and abundant feed, clean stables and houses, and proper ventilation and sunlight are conducive to health and retard the disease. The absence of such conditions can never produce the disease, nor can the best sanitary conditions prevent its progress in a herd. The disease spreads as rapidly among cattle kept out-of-doors constantly, as in stabled animals. Indeed, stabling removes in part one important agent in the spread of the disease, the direct contact of diseased with healthy animals.

Is tuberculosis inherited? Only when the reproductive organs are diseased. This is so infrequent that the young of tuberculous parents are almost certain to be free from the disease at birth. This fact forms the basis of the Bang method of freeing a herd from the disease.

How is the disease introduced into the herd? By bringing something onto the farm that contains the organism, chiefly a diseased animal or the products of diseased animals such as milk, whey, buttermilk, eggs or meat scraps in garbage. Contact with diseased animals through line fences, contaminated cars at fairs and shows. and possibly flowing water, wild birds, and wild animals are other agencies by which the disease is spread. If the farmer will control as many of these as he can, he need have little fear from others.

How does milk become infected with tubercle bacilli? Once the tubercle bacilli leave the body, they get into the milk in many ways, as through the introduction of manure and dust from the coat of the cow during the milking. The cleaner the method of handling the milk, the less important is this source of infection. Milk also may become contaminated from healthy cows in a tuberculous herd if the coat of the healthy animal becomes soiled with manure containing tubercle bacilli.

Tuberculosis of the udder is not frequent, while open tuberculosis of the lungs, liver and intestines is more common. It is difficult to tell which source of contamination is more important. Far greater numbers of the organisms will be found in milk from tuberculous udders than would ever get into it from other sources, but contamination from other sources is more frequent and therefore may be of prime importance.

How frequently does milk contain tubercle bacilli? This varies widely. In sections where many of the milk cows are tuberculous, the mixed milk from a number of herds is sure to contain tubercle bacilli almost constantly, in greater or less numbers. In single herds, the contamination of milk depends upon whether there are "open" cases. If a cow has tuberculosis, the milk may contain tubercle bacilli. In order to be certain that the milk does not contain them, the herd must be free from the disease.

Is milk an important means of spreading tuberculosis? Calves and hogs acquire tuberculosis easily when fed on contaminated milk. The widespread use of whey, skimmilk and buttermilk as feed for calves and hogs makes milk one of the chief means by which the tubercle bacilli are carried from farm to farm. The high percentage of tuberculous hogs from cheese-producing districts is evidence of this mode of transmission. One animal with open tuberculosis of the udder is sufficient to produce trouble even when the milk is mixed with that of hundreds of healthy animals.

Eggs may contain avian tubercle bacilli and such eggs may hatch normally. It is thus possible to introduce avian tuberculosis onto the farm through the purchase of eggs or day old chicks.

How can the spread of tuberculosis by milk and other dairy products be prevented? The patron of a cheese factory or creamery carries to his calves and hogs in the form of whey, skimmilk and buttermilk, a mixture derived from all the patrons. It is important that these by-products be treated to destroy any tubercle organism they may contain. This can be done by heating the skimmilk and whey or by pasteurizing the cream before churning. If skimmilk or whey is heated to 155 degrees F., and allowed to cool slowly, all tubercle bacilli will be killed. The heating can be done with inexpensive apparatus by injecting steam into the whey or skimmilk. Heating whey and skimmilk insures their return in a sweet condition to the farm and enhances their feeding value over that of sour, fermented by-products. The treatment of the by-products improves the quality of the milk, since the cans are not contaminated with harmful bacteria which may get into the milk when the cans are poorly washed. The process of heating whey is spreading rapidly in Canada for the sole purpose of improving the quality of milk. The use of the farm separator overcomes the danger of introducing tuberculosis from creamery skimmilk. The creamery separator slime should never be used as feed.

What is the chief way of introducing bovine and avian tuberculosis? Buying a diseased animal which has open tuberculosis, or later develops it, is the chief way. Such a transaction is like buying clover and alfalfa seed containing seeds of a noxious weed. The danger of introducing the disease through purchase of a tuberculous hog for breeding purpose should also be guarded against.

Is it wise to introduce an unsound or unhealthy animal into a herd? Any farmer about to purchase a horse examines it for soundness. Yet spavin, ringbone, heaves, cribbing, and balking are not directly transmissible troubles. As tuberculosis is an unsoundness of cattle, hogs and poultry transmissible to other animals, every tuberculous animal is likely to cause the farmer more loss than many spavined horses because:

1. Tuberculosis causes the death of a certain number of animals after it has become established in a herd.

2. Tuberculosis causes a waste of food when it is fed to animals that cannot give an adequate return.
3. Tuberculosis causes heavy loss through the infection of other animals.
4. Tuberculosis reduces the market value of animals. As soon as an animal shows physical evidence of the disease, it has no market value.
5. Tuberculosis destroys the reputation of a herd or flock, making it difficult to sell animals. Especially is this true in purebred herds and flocks.

Why does the farmer so frequently fail to appreciate the danger from tuberculosis? Every farmer is afraid of hog cholera because it quickly causes large losses. It appears, destroys the majority of the herd, and disappears. Tuberculosis causes greater ultimate loss but attracts little attention because it develops slowly in the animal and may require years to produce death. The animal declines so gradually that it seems as though some inevitable, unpreventable trouble were present. So human tuberculosis used to be considered. Now, however, it is looked upon as preventable and curable.

The losses in poultry are more striking since they come quickly and hence the attention of the farmer is frequently drawn to the disease in his birds, when its presence in his cattle and hogs passes unnoticed.

HOW TO DETECT TUBERCULOSIS

How can tuberculosis be detected? A physical examination of a tuberculous animal fails to show the presence of the disease except in the later stages. The only certain means of detecting tuberculosis in all stages in the living animal is the tuberculin test.

What is the tuberculin test? If a small quantity of tuberculin is introduced into the body of an animal free from tuberculosis, no effect is produced, but with a tuberculous animal an effect or "reaction" follows which varies with the manner in which the tuberculin is applied.

What is tuberculin? Tuberculin is a clear, tea-colored liquid containing the by-products of the tubercle bacilli and a portion of the content of the cells. It is impossible for tuberculin to contain any living tubercle bacilli since it has been heated to 212 degrees.

How is tuberculin applied? Tuberculin is injected beneath the skin in the thermal or subcutaneous test. The reaction is primarily a fever of short duration and of varying intensity. In the intradermal or tail test, the tuberculin is injected between the layers of the skin and the reaction consists of a swelling at the point of injection. The tuberculin is placed in the eye in the ophthalmic test and the reaction with a tuberculous animal is an inflammation of the eye.

Which of the tests are used in examining cattle? Any one of the three tests may be used. The thermal and intradermal tests may be used alone or together, the ophthalmic test ordinarily is used only with one of the others. It is commonly applied immediately after one of the other tests to confirm the results. The thermal test was first devised and was practically the only one in common use with cattle until very recently. It is now being rapidly supplanted by the intradermal test which is the only one used on hogs and birds.

Does the use of tuberculin injure animals? Tuberculin has no effect whatever on healthy animals and no harmful effect on tuberculous animals. It has no effect on the progress of the disease in the animal, nor can it in any way produce the disease. With many herds it has been used regularly for twenty-five years with no injurious effects. The test does not cause abortion or other ailments and the flow of milk is not changed greatly even in a tuberculous animal.

What are the advantages and disadvantages of the three tests? The subcutaneous test is the simplest and the one with which most of the testing has been done. It has the disadvantage of requiring the time of the tester for twenty-four continuous hours; and the results may be influenced by any condition causing a rise of temperature, such as presence of some other disease or excitement in case of cattle and hogs.

The intradermal test has the disadvantage of requiring more skill in applying the tuberculin and in interpreting the results. Experience is absolutely necessary if the operator is to do efficient work. It requires but little time and is not influenced by any other condition of the animal than the presence of the disease.

The ophthalmic has the same advantages as the intradermal but is more difficult of interpretation.

How is the thermal tuberculin test made? The application of the test may be divided into three parts: (1) Determining the normal temperature of the animal; (2) Injecting tuberculin; and (3) Determining whether a fever has resulted.

Why is it necessary to determine the normal temperature? The temperature of cattle, unlike that of man, varies widely not only in different animals but in the same animal at different times. The temperature of a cow is usually between 101° and 102° F.; that of calves and fat stock is somewhat higher, while aged cows and those low in vitality usually show somewhat lower temperatures.

How many temperatures should be taken in order to determine the normal temperature? At least three, and preferably four temperatures should be taken at intervals of two or three hours. Each animal should be marked so there will be no danger of confusion. This can be done by placing a gummed label or a piece of adhesive tape on the hair near the hips.

When is the tuberculin to be injected? The injection should be made at such a time that the temperature can again be taken eight hours later. From 8 to 10 in the evening is the most convenient time, as it is then possible to begin the second series of temperature readings in the morning.

How many temperatures are taken after injection? The readings are usually begun at the eighth hour after injection and continued at two-hour intervals until at least the twentieth hour. With all animals that show a fever, the temperature should be taken until it begins to fall in a decided manner.

How should the animals be cared for during the test? As far as possible they should be handled in the regular manner. Cattle not fed or watered at accustomed times may become nervous, and the temperature will rise. If the daily routine is not such as will enable the test to be made conveniently, change a week or ten days before the test is to be made so that the cattle may become accustomed to it. During the test the cattle must be kept in the barn for about 24 hours.

Attention must be paid to the watering during the test, especially while the temperatures are being taken after injection. If an animal drinks a large amount of cold water, the temperature will be lowered. It is possible to have fever produced by the tuberculin, and because of drinking a large amount of cold water, the temperature may be so lowered that the fever will not be detected. This may lead to incorrectness in interpreting the temperatures and a cow may be passed as healthy when in reality she is diseased. If the water is warmed, it can be given in any amount. If cold water must be used and the animals are generally watered during the morning when temperatures are taken, a pailful may be given to each animal every hour or so, preferably immediately after a reading has been taken. The small quantity will not affect the temperature. Care should also be taken that none of the preliminary temperatures are lowered by the watering.

What animals should not be tested with the thermal test? The temperatures before injection serve to show not only the normal temperature of each animal, but whether any have a fever. Such animals should not be tested because it cannot be told with certainty whether the fever on the second day is due to the same cause or to the tuberculin. As a rule, the following animals should not be tested:

1. Those soon to calve.
2. Those that have just calved, especially when the afterbirth was not discharged in a normal manner.
3. Animals in heat.
4. Animals suffering from garget (mammitis), or inflammation in other parts of the body.
5. Animals that have aborted within a short time.
6. Those that show a single temperature before injection of 103.5° F., or above. Calves and fat stock may have a normal temperature of 103° to 103.5° and may be tested if all of the temperatures are uniformly high. It is not considered wise to test calves under three months old.

Animals in these classes may be tested with the remainder of the herd, but if any show a reaction, it is usually advisable to hold them for a retest. If no reaction occurs, the test is as reliable in the case of such animals as in any. Animals with abnormal temperatures should not be tested under any condition.

When is the best time to test? The most convenient time to test is while the cattle are in the stable in the fall or spring. It can be done at any time during the winter but not so conveniently in very cold weather.

During the summer the cattle must be taken out of the pasture and kept in the stable. This causes them to become uneasy. During very hot weather, the temperature of the cattle may be high and may lead to errors. Summer testing can be done, if necessary, but the work can be done more satisfactorily during the fall and winter.

How are the temperatures interpreted? The average of the temperatures before injection is determined and if the highest temperature after the injection is 2° F. or more above the average normal the animal is generally regarded as having given a positive reaction. Usually the rise in temperature of a tuberculous animal is much greater—4 to 6° F.—and there is no question as to the result. When the rise is approximately 2° F. and the temperature is not above 104° F. at any time, the reaction is classed as doubtful. In all cases records should be interpreted by an experienced person who has all the facts about the animals, the age, whether raised or purchased, whether from a healthy or diseased herd, the number of reacting animals in the herd tested, and whether tested previously or not.

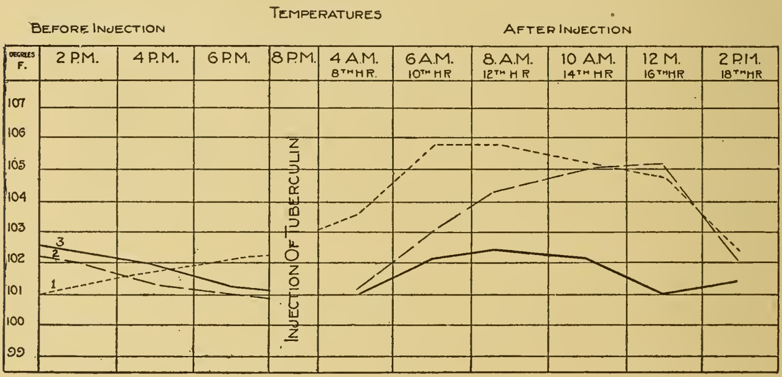

FIG. 7.—WHAT HAPPENS AFTER INJECTING TUBERCULIN?

A rise in temperature follows the injection of the tuberculin into tuberculous animals. Temperature curves 1 and 2 are of tuberculous animals, and curve 3 of a healthy animal.

The positive tuberculin reaction generally shows a regular rise in the temperature, which remains at the highest point for only a short time, then falls gradually to the normal. The decline is usually more rapid than the rise although there are exceptions. The character of the curve should also be considered. A widely fluctuating temperature which is high, then low, and later high, should usually be classed as a doubtful rather than as a positive reaction.

Are any changes to be noted in a reacting animal other than the rise in temperature? Some of the reacting animals show the effects of the tuberculin by shivering, staring coat, refusal to eat, and other symptoms. In some cases these symptoms are very noticeable, in others they do not appear at all. No such symptoms are ever noted with non-reacting animals. In the case of reacting animals, a slight swelling at the point of injection is frequently noted.

What should be done with animals that give doubtful reactions? They should be retested, but not before at least sixty days, as a tuberculous animal often will not react to a second dose of tuberculin injected soon after the first. Time must be given for the original tuberculin to be eliminated from the system. When retested, a triple dose should be given and the taking of temperatures should be begun about three or four hours after the injection of the tuberculin and continued until the twentieth hour. The reaction fever appears quickly in many animals on the retest, and if the temperature is not taken until the eighth or tenth hour, as in the original test, the high point of the fever may be missed.

How is the intradermal test made? A few drops of a special kind of tuberculin is injected into the skin of one of the folds beneath the tail in case of cattle. The tuberculin makes a little nodule or swelling which soon disappears. A positive reaction is indicated by a swelling which is evident at the 72nd hour after injection, or in a few cases, at a later hour, as the 96th or 120th. A swelling which may be noted at the 24th or 36th hour and which soon disappears, is not classed as a specific reaction. The nature and size of the swelling must be considered in interpreting the test. Practice with an experienced operator is essential for efficient work. In hogs the injection is made into the skin at the base of the ear, and in poultry into the skin of the wattle. The positive reaction is again determined by the size, nature and time of appearance of the swelling.

The intradermal test has many advantages over the subcutaneous test. It can be used on all classes and ages of cattle and at all times of the year. The results are not influenced by temperature, by the care of the animals, nor by the presence of another disease. It requires but little time on the part of the veterinarian. It is as accurate as the older and more troublesome subcutaneous test.

How is the ophthalmic test made? A small quantity of a special form of tuberculin is placed in one eye. Frequently the tuberculin is mixed with some inert material to form tablets which can be placed in the eye more easily than can a liquid. Often a tablet is applied and 24 hours later another. The first is called a sensitizing dose since through its use a positive reaction is more likely to be obtained in case of a diseased animal. A reaction is shown by an inflammation of the eye, the untreated eye remaining normal. The degree of inflammation must be considered in interpreting the test. Like the intradermal test, it demands much practice in order to obtain correct results.

This test has the same advantages as the intradermal, in that it can be applied with little time and is not influenced by the factors that interfere with the temperature of the animals.

What is the comparative value of the tests? There are possibilities of error in either of two directions with any of the tests. The tests may not detect all diseased animals or they may indicate a healthy animal as a diseased one. The latter error is the least important. The failure to detect evidences of tuberculosis on post-mortem examination does not mean the animal was not diseased, since the lesions may be so small or so hidden as to escape notice. On careful examination lesions have been found in the following percentage of animals reacting to the different tests:

Thermal test	92.9 %
Intradermic test	91.3 %
Ophthalmic test	91.0 %

The failure to indicate tuberculosis in the tested animal is especially important since it may result in a diseased animal getting into the herd or may allow one to remain there. Its magnitude can only be estimated. That it is not very great is shown by the success in protecting and freeing herds from tuberculosis.[1]

In what stages of the disease may animals not react? Animals in which the disease is far advanced and in which much diseased tissue exists do not always react to a normal dose of tuberculin. Such animals, however, usually show physical signs of the disease. It is necessary that the tubercle bacilli in the body grow to some extent before they can be detected by the tuberculin test. This is commonly called the "period of incubation." In other words, tuberculosis during the first stages cannot be diagnosed by the tuberculin test nor by any other means. The "period of incubation" may be several months in length.

Animals in which the disease has ceased to progress may not react. An animal may react once, then not react for a number of subsequent tests and then again react, because the disease has been active, then dormant and has again become active. Sometimes a reaction may be obtained to one of the tests and not to the others. It has, therefore, come to be the practice to use them in various combination in retesting suspected animals.

Do cattle recover from tuberculosis? Some animals react once, but not on subsequent tests. If failure to react depends upon the disease becoming dormant, such a condition might be taken to indicate recovery. So little is known about recovery from bovine tuberculosis that it is not advisable to take it into account.

Does the tuberculin test tell anything about the extent of the disease in the animal? Nothing whatever. For an animal with a single diseased gland may give as marked a reaction to any of the tests as one badly diseased.

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[1] The experience of the New York Experiment Station is illuminating in regard to the correctness of the thermal test. During the past 20 years a total of 816 individual tests were made in the herd of this institution. Only three errors were noted.

THE CONTROL OF TUBERCULOSIS IN THE HERD

How can a diseased herd be freed from tuberculosis? Test the whole herd. Remove all reacting animals. Retest all suspicious animals in three months, and the entire herd again in one year and annually thereafter. If over 50 per cent of the animals react, it is not advisable to divide the herd but to consider all animals diseased. It is quite certain that a portion of the non-reacting animals have dormant tuberculosis. Clean and disinfect the stable.

How long will it take to free a herd from tuberculosis? It depends on the extent of the disease in the herd. If but few animals react to the test, it is probable that after two or three tests no further reactions will be obtained. If many animals react, it may require several years to eliminate the disease, due to the dormant cases.

How can a herd be kept free from tuberculosis? Test the entire herd annually or at least every two years, and retest all suspicious cases in three months. Test every animal introduced into the herd at the time of purchase and again in three months. Use a farm separator or feed skimmilk and whey only after having been heated. Protect against contact with animals of other herds.

Before the introduction of the intradermal test, the examination of every animal brought into a herd meant so much expense that it was likely to be neglected. There is little excuse for such neglect at present, for a veterinarian can apply the intradermal test in a short time and without interfering with his regular practice. A visit to apply the tuberculin, and another three days later to inspect is all that is needed.

If a veterinarian is not easily obtained, the owner should apply the thermal test to animals he is bringing into his herd. The test is easily made. No one but an experienced operator should attempt the intradermal or ophthalmic tests, due to difficulty in interpreting the results.

Is the above plan sure to prove successful? No, because an animal in the period of incubation may be purchased, she may not react at the first or second test, and yet before the next test, nine to twelve months later, she may infect other cows.

How can the owner be sure he is not introducing tuberculosis into the herd? By buying animals only from herds known to be free from tuberculosis and by buying the minimum number. A herd that is constantly changing by sale and purchase is very likely to become invaded by tuberculosis. A purely breeding herd, maintained by its own progeny with the exception of the purchase of a male animal at infrequent intervals, is far more likely to be kept free from disease than a herd into which animals are being brought.

Can a healthy herd be raised from a tuberculous herd? Since the calves from tuberculous cows are quite sure to be free from the disease when born, a healthy herd can be raised from a diseased foundation by removing the calves from their dams as soon as born. (It is usually wise to allow them to suck once or twice, since failure to receive the colostrum milk makes them much more susceptible to many troubles prevalent in calves.) Afterward, feed them on the milk of healthy cows or on milk that has been heated to not less than 150° F. for twenty minutes. The calves are not to be kept in the same stable, yards, or pastures with the diseased animals; in short, no communication of the healthy calves must be allowed with the diseased cows.

This is the "Bang" method of eliminating tuberculosis and is valuable in maintaining breeding strains. It is commonly too expensive and troublesome when grade herds are concerned.

How can a breeding herd of hogs be protected from tuberculosis? The danger of introducing the disease through feed and through the purchase of animals is the same here as in bovine tuberculosis. One should inquire about the health of herds from which animals are to be purchased. The intradermal test may be used.

It is not believed that the transfer of the organism from hog to hog is an important factor in the spread of the disease, since so few hogs are kept long enough for the open phase of the disease to be reached. The infection of hogs is apparently largely from cattle and possibly to some extent from birds, the carcasses of which have been fed to the hogs.

How can the poultry be protected? The disease is introduced as with cattle and hogs. Inquiry about the health of flocks from which birds are to be bought is especially important. A breeder with a tuberculous flock is very likely to know it because of the marked symptoms and lesions of tuberculosis in birds.

If a flock is tuberculous, it is usually best to dispose of it. A new flock may be started by the purchase of young chicks from healthy flocks. These birds should not be allowed to come in contact with infected yards or houses.

The intradermal test made with tuberculin prepared by use of the avian tubercle bacilli can be used to free a flock from tuberculosis. There is evidence that success will follow its constant and persistent use. The expense involved is likely to be greater than the replacement of the diseased flock as a whole.

How can barn and poultry houses be disinfected? The rooms should receive a thorough cleaning. Remove all litter and loose woodwork, such as box mangers; and scrape walls and floors to remove all accumulations of dried manure and dust. This can best be done after moistening with a 2-3 per cent solution of some one of the common coal-tar disinfectants. This removal of litter and dirt removes most of the tubercle bacilli from the stable and allows the disinfectant to come in contact with the remainder. Do not place the material removed from the stables and houses where animals have access to it.

Provide abundant light, four square feet of glass per bovine animal, and some means of ventilation for the stable. Cows in light, well-ventilated stables are healthier and somewhat less likely to acquire tuberculosis than those kept under less sanitary conditions. Provide plenty of light and air in poultry houses.

Whitewash the rooms. Prepare whitewash as follows: To each 100 parts of fresh lime add 60 parts of water; the result should be a dry powder. Sift the slaked lime and add water at the rate of four quarts of water to one of lime if the wash is to be applied with a brush. This slaked lime can be replaced with hydrated lime carried by all dealers in lime and cement. This is very fine and can be mixed with water without any treatment. It is preferable to apply the whitewash with a spray pump since by this method it can be forced into every crack. For this purpose the solution must be thinner than when applied with a brush. Whitewash the stables, pens and poultry houses at intervals of six months or at least once a year.

The tubercle bacilli remain alive for weeks in dirt and manure, a fact of especial importance in avian tuberculosis. The yards and the ground beneath buildings and feeding grounds become contaminated and cannot be disinfected. One must wait for them to be freed from the tubercle bacilli by natural agencies before healthy birds can safely be allowed to come in contact with them. The sale of a diseased flock in the early spring, the raising of young birds on fresh ranges during the summer, and the use of the cleaned and disinfected houses and yards in the late fall, will probably enable one to get rid of the disease.

What is an accredited herd? A tuberculosis-free accredited herd is one in which no animal affected with tuberculosis has been found upon two annual or three semi-annual tuberculin tests and by physical examination applied by a regular employed veterinarian of the United States Bureau of Animal Industry or of the cooperating state.

The owner agrees that his herd shall be tested or retested when it is considered necessary by the federal and state authorities. He also agrees not to admit any cattle to his herd, except from an accredited herd, until they have passed two tuberculin tests applied at intervals of not less than sixty days or more than ninety days by an authorized veterinarian. When the herd has been officially accredited, the subsequent annual tests shall be made at the owner's expense by an authorized veterinarian.

The owner agrees to keep his stables sanitary and to promptly remove any reacting animals; to feed calves only on the milk of an accredited herd or on that which has been heated to not less than 150° F. for not less than 20 minutes; and to comply with all reasonable suggestions of the federal and state authorities.

The owner of the accredited herd has the advantage of having the preliminary tests made without expense to himself and under the best possible conditions by men whose only interest is to assist him in obtaining a healthy herd as quickly as possible. Cattle from accredited herds can be shipped freely into other states, since practically all states recognize such tests for importing purposes. This is of great importance to Wisconsin farmers since they are selling many cattle to other states. The advertising value of an accredited herd is considerable since such herds are listed in federal and state publications and in this way are brought to the attention of prospective buyers of healthy cattle.

What is an area test? The Wisconsin laws provide that when 60 per cent of the cattle owners of a county sign a petition asking that the state test all the cattle in the county, the State Livestock Sanitary Board is authorized to test all cattle without expense to the owners. The intradermal test is used. The reactors are removed and the infected herds retested. The entire area is retested in two or three years at the expense of the county. Restrictions in regard to shipment are enforced to avoid the introduction of tuberculous cattle into such tested areas.

What is a tuberculosis-free area? When all the herds in an area are accredited, the area is termed tuberculosis-free and cattle can be shipped from there with the same freedom as from an individual accredited herd.

What is a modified accredited area? This phrase is applied to any area such as a county, in which all cattle have been tested by cooperating federal and state authorities alone or with other cooperating agencies such as the county, and not over one-half of one per cent of the cattle react. The infected herds are retested in not less than sixty days from the original test. Cattle from such areas can be shipped to other states without retesting. The large packers have agreed to pay a premium of ten cents per hundred for hogs from such areas.

What regulations are in force concerning shipment of cattle into the state? Cattle cannot be shipped into the state except in accordance with the rules of the State Department of Agriculture. Those who are to import cattle should ask the State Veterinarian, Madison, for a copy of the rules.

Somewhat similar regulations are in force as regards the shipment of cattle into counties in which all the cattle have been tested. To avoid trouble and inconvenience in shipments, a copy of the regulations should be obtained.

INDIVIDUAL AND COMMUNITY INTERESTS IN TUBERCULOSIS

Why do owners want healthy herds? The herd owner is vitally interested in its health from the standpoint of the safety of his family and from that of financial success. Every cattle owner should welcome the aid given in the accredited herd work and in the area work and do all that he can to supplement the efforts of the federal and state governments in his behalf.

What are the community interests in tuberculosis? Every cattle owner is interested in the health of the herds of his immediate neighbors since infection may in so many ways invade his herd from another. He is also interested in the health of all herds supplying milk to the creamery or cheese factory from which he is obtaining feed for calves and pigs. He is interested in the health of all the herds of his county for only as all are free from tuberculosis can he realize to the full the advantage of a ready and profitable market for surplus cattle, for buyers prefer to visit areas where no questions need be asked concerning the health of the animals. Again, if a great milk condensing firm finds it profitable to advertise their products as coming from "contented" cows, Wisconsin counties should find it profitable to advertise that their butter and cheese are made from the milk of "healthy" cows.

The Wisconsin laws provide that a permit may be issued by the State Department of Agriculture to label dairy products as having been made from the milk of tuberculosis-free cows. Such privilege is given to all creameries and cheese factories in a county or to an individual plant when all the cattle of its patrons have successfully passed the tuberculin test.

What is the federal government doing to aid the farmer in combating tuberculosis? The federal government is cooperating with the states in area test work and in the accredited herd work, both by supplying men and by the payment of indemnity for reacting animals. The federal government is doing this because it realizes that bovine tuberculosis is a country-wide problem and not one of any state or limited area.

How is the state aiding the farmer in combating tuberculosis? The state is cooperating with the federal government in area and accredited herd work and is carrying alone the cost of indemnifying owners of herds which have been tested by local veterinarians and in which reactors have been found.

The tuberculin for such tests is supplied without cost by the State to the veterinarian and the diseased animals are marketed in such a way as to secure the maximum salvage for the owner.

The reacting animals are shipped under the direction of the Livestock Sanitary Board to slaughterhouses in which federal meat inspectors are stationed, Milwaukee, La Crosse, Wisconsin Rapids, Eau Claire and Madison in this state. Under certain conditions they may be shipped to St. Paul or Chicago. The animals are killed under federal supervision and the owner receives the total net proceeds, the amount of which will depend on whether the meat was considered fit for food or not, the quality of the meat and the amount of transportation and killing charges. The owner then receives from the federal government and from the State, or from the State alone, a sum equal to one-half the difference between the sum at which the animal was appraised by the authorities and the net salvage. This sum cannot exceed $90 for registered animals and $40 for non-registered cattle. No indemnity is paid for tuberculous hogs or poultry.

The present laws provide that the owner shall receive no compensation for cattle, until the infected premises have been disinfected in such manner as to prevent further spread of the disease in the herd. No compensation is paid for an animal:

1. Which the owner knew or had good reason to believe was tuberculous when purchased.

2. Which was diseased when brought into the state.

3. Which has been exposed by the owner to infection.

4. Which has been brought into the state within one year prior to its slaughter and which has not passed a tuberculin test made subsequent to the one made at the time the animal was brought into the state. In other words, an animal killed within one year after importation must have given a negative reaction at that time and another later, thus showing that the infection had been acquired after importation.

5. Which has come from a herd which has not been tested within two years, unless the owner of the herd shall agree to test his entire herd.

6. No indemnity is paid if the owner has received indemnity as a result of a former test and has thereafter introduced into his herd an animal which has not passed a test approved by the state authorities.

7. The owner must agree to retest his entire herd at least every two years and more frequently if the state authorities deem it necessary before indemnity is paid.

It is to be noted that indemnity if paid only to those who are making an honest effort to safeguard the health of their herds.

What of the future? The federal and state governments are paying indemnity for tuberculous cattle because of the sanitary importance of tuberculosis and because of community interests in the disease. The sanitary side is being cared for more and more completely each year through the pasteurization of milk supplies and through the pasteurization of cream in butter making. The consumer is paying for the protection thus secured and it is only a question of time when the federal and state governments will not consider it wise to continue to pay indemnity on account of a disease that is important chiefly from the standpoint of the health of the farmer's own family and from the standpoint of his financial success.

It is believed that the ultimate solution is a mutual protective association of all cattle owners in a county, each of which shall contribute in proportion to his interest to a sum which shall be used to make the necessary examinations and to indemnify the owner who has done his part in attempting to keep his herd free from tuberculosis. Such a protective association should be under the direct control of the state agency intrusted with livestock sanitation, in order that the work may be done economically, effectively and uniformly in any county, and that the interests of the counties and of the state at large be protected. The farmers of this state must look forward to such a change in the struggle against this important transmissible disease of cattle, hogs and poultry.

—MEMORANDA—

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What to Feed the Children

EXTENSION SERVICE
OF THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN, MADISON

"MUCH EMPHASIS is rightly given to the advocacy of maternal feeding but in order that breast milk may actually show the superiority that we are accustomed to expect of it, the attention paid to maternal feeding should take account of the food consumed by the mother as well as of the extent to which the mother nurses the child. In the mother's diet, milk should have a prominent place, since it constitutes such an important supply of the nutrients from which the breast milk is to be formed."

What to Feed the Children

Dorothy Reed Mendenhall, M. D.

THE CHILD'S FOOD is the foundation for his future.

Health and disease, strength and weakness, usefulness and uselessness may be the result of feeding in childhood.

The quality of a child's diet is more important even than the quantity. Only certain kinds of food can be built up into body tissue or promote growth. Therefore the choice of the child's food cannot be left to chance but must be a matter of careful thought from early infancy if the best growth of body and mind is to be insured.

BREAST FEEDING GIVES THE BEST START

A breast-fed child has ten times the chance of a child who is entirely bottle-fed. Mother's milk is the natural food for the baby and can practically always be made to agree with him. Breast feeding not only is the best assurance of normal growth, but actually protects the child from disease, for a nursing baby has the same immunity as his mother.

The contagious diseases of childhood may kill the weak and unfit. Usually they impair for a time at least the health and yearly growth of those strong enough to survive. In many cases, permanent organic injury follows these so-called "harmless children's diseases." Any serious disease or physical defect may stunt the physical or mental development of the child.

How Much Should Children Gain?

An average infant weighing at birth between seven and eight pounds should double his birth weight at the end of five months, and treble it at the end of one year. An infant should gain more than one-fourth of a pound a week the first six months and slightly less than this the second six months.

From one year to 11 years a child should gain about five pounds a year. During the twelfth, thirteenth, and fourteenth years a girl should gain about 10 pounds a year. During the thirteenth, fourteenth, and fifteenth years a boy should gain from 10 to 14 pounds a year. Sufficient food, sleep, and fresh air are the chief essentials for growth.

FEEDING BY THE CLOCK

Regularity in feeding is of the utmost importance. Babies should be waked to be fed during the daytime. A fixed routine of feeding is one of the best ways to establish proper health habits in infancy.

HOW MANY FEEDINGS?

From Birth to 4 Months—From 6 o'clock in the morning to 10 o'clock in the evening, the baby should be fed not oftener than every three hours. With one feeding during the night this will make a total of not more than seven feedings in 24 hours. Many babies do better on a four-hour interval from the outset, making the total of not more than six feedings in 24 hours.

Artificially fed babies should always be put on the longer interval between feedings, because cow's milk takes longer and is more difficult to digest than mother's milk.

From 4 to 6 Months—A four-hour interval between feedings should be established, with a total of not more than five meals in 24 hours. All babies should be on a four-hour feeding interval before solid food is started.

From 6 to 18 Months—There should be four or five feedings in 24 hours, with at least four hours between feedings. The 10 p. m. or night feeding should be omitted whenever the infant will sleep all night without it and is gaining normally in weight.

Nursing—The nipple should be washed carefully with boiled water before nursing and kept covered between nursings with a piece of clean linen. If one breast does not furnish enough milk. both should be given. Completely emptying the breast is the best way to keep up the supply of milk. The child should be kept nursing from 5 to 15 minutes and not allowed to sleep or play while feeding. At the end of this time the breast or bottle should be taken away and three or four hours (the usual interval) should pass before food is offered again. Do not nurse or feed a baby because he cries. Children often cry from over feeding or too frequent feeding.

If a mother has enough breast milk, there should be no difficulty in adapting it to the child's needs. A breast fed baby gaining regularly at least a quarter of a pound a week is getting plenty of milk. Weighing the baby in its clothes before and after nursing several times a day will tell just how much milk he is receiving. As a rule, in the late afternoon the milk is apt to be scanty. Giving some diluted cow's milk after one nursing will help out the breast milk and enable the child to gain regularly in weight. Part breast and part bottle may be given for months with good results if properly managed. Giving an entire bottle feeding regularly instead of the breast may tend to diminish the breast supply and necessitate weaning.

How to Give the Bottle—Until the child can hold it himself, the bottle should always be held by the mother while he is taking either food or water. If all the food is not taken at one feeding, that which is left should be thrown away and never warmed over for another feeding.

After Nursing or Feeding—The baby should be held and patted gently to bring up the gas, generally the air which he has swallowed, then he should be placed in his crib.

A child should never be played with or rocked after feeding.

ARTIFICIAL FEEDING DURING THE FIRST YEAR

How Much Milk Should be Given?—In order to gain, a young baby needs daily at least 1½ ounces of whole mixed milk for every pound he weighs. Especially with very young babies it is well to begin by giving less than this and to increase the amount of milk given daily until it is about 1¾ ounces per pound weight. Two ounces of whole milk per pound of body weight per day is more food than most infants can stand and more than they need if sugar and starch are used in modifying the milk.

Milk should be scalded for the use of young infants because heating the milk to this temperature (about 167° to 185° F.) changes the curd of milk and makes it more easily digested. Scalded milk, unlike boiled milk, is not constipating nor is the food value of the milk essentially altered. It is also a safe milk because all ordinary bacteria are killed at this temperature. It is not necessary to boil milk for the use of well babies.

Diluting Milk—Boiled water is first used to make up the amount of food necessary for the entire day. Cereal water may be substituted for plain water after the first month and is easily digested by the average child. It should be made weak at first and its strength gradually increased.

The amount of water or cereal water necessary for diluting the milk depends on the amount of fluid a baby is to be given. In 24 hours the average young infant needs about three ounces of fluid per pound of body weight. This is gradually reduced, as a child grows, to 2 ounces of fluid per pound body weight at one years of age. Milk contains so much water that it can be calculated as fluid if a generous amount is given.

How Much to Give at a Feeding—The amount of food to be given at a feeding is determined by dividing the total amount of diluted milk needed in 24 hours by the number of feedings to be given in this period. Usually during the first six months a baby can take about 2 ounces more at a feeding than he is months old. If he is fed oftener than every four hours, the amount given at a feeding may have to be more restricted.

Cereal Water and Gruels—During the early months cereal water is made by using one-half a level tablespoonful of a barley or wheat flour to 16 ounces of water, and cooking the mixture for at least one-half hour in a double boiler. At 4 to 6 months a baby may be gradually accustomed to 2 level tablespoonfuls of flour to 12 ounces of water, and from 6 to 9 months to 3 level tablespoonfuls of flour cooked in 10 ounces of water. Whole cereals can be used instead of flour in making cereal water and have the advantage of being laxative in effect and containing more vitamins. They, however, require long cooking (4 to 6 hours) and straining to be suitable for infant use.

Gruels made of fine ground or whole cereals (strained) should be begun by the fifth month with either breast or bottle fed children. At first one tablespoonful of thick, well cooked cereal may be fed to the baby by means of a spoon, just before any breast or bottle feeding. The cereal may be cooked with cow's milk or part cow's milk instead of water or 1 to 2 ounces of scalded cow's milk may be poured over it and fed with it. A little sugar may be used on it if preferred, or if no other sugar is given in the food, but the average baby will eat it as willingly unflavored.

Sugar—Cane sugar is ordinarily just as easily digested by the infant as any form of sugar and has the great advantage of cheapness. The amount given should vary from one-half a tablespoonful to 3 even tablespoonfuls in the 24 hours, according to the age and size of the baby. Certain preparations of malt sugar which contain dextrin-maltose are much used because of their laxative action. When these malt sugars or milk sugar are used one-third more by measure than is suggested for cane sugar should be given as cane sugar is about one-third heavier.

Fruit Juice—Fruit juice promotes the growth and health of babies and should be given by the beginning of the third month. The juice of sweet oranges or tomatoes even in small amounts furnishes sufficient vitamins to prevent scurvy and to promote normal growth and resistance to infectious disease. Breast-fed babies are in much less danger of being kept on a diet low in vitamins than are artificially-fed babies.

It is safer, however, to give every infant over two months old according to his age from 1 teaspoonful to 4 tablespoonfuls of orange juice diluted with at least equal parts of water once or twice a day. The juice of canned tomatoes is equivalent in vitamin value to about half as much orange juice. Tomato juice can be given undiluted and in amounts from 1 to 8 ounces daily according to age. Prune juice or apple juice cannot be used as an equivalent to orange juice. Fruit juices are best given on an empty stomach from 1 hour to ½ hour before feeding.

Vegetables—Because of the high mineral and vitamin content, vegetable pulp or vegetable soup should be given to all children once a day from six months of age through childhood. From 1 teaspoonful to 2 tablespoonfuls of vegetable pulp may be given immediately before a bottle or breast feeding. Vegetable water may be used to dilute milk in a bottle feeding for the young infant under 6 months of age or strained vegetable soup in amount from 2 to 6 ounces may be used to replace part of one feeding, breast or bottle, at any time after the third or fourth months.

Giving cereal and vegetable pulp early to breast fed children as well as to bottle fed babies will prolong the mother's ability to nurse and make weaning easy. Many children fail to grow and to gain normally at the end of the first year. This is prevented by an early transition to the proper mixed diet, which gives not only more material for growth but specially more minerals for bones, teeth and blood and more vitamins to stimulate growth.

Bread—After 8 to 10 months, a child may be allowed a small piece of dry bread or toast once or twice a day after or before a breast or bottle feeding. This teaches the baby to chew and to use dry food. The amount of his food is also increased.

Water—At least twice a day boiled and cooled water should be offered to every baby between feedings. After the second month, fruit juice may be added to the water once or twice a day. Both water and fruit juice should be given to the young baby in a bottle because in this way the use of the artificial nipple is taught.

Weaning a baby on the spoon and cup during the first year usually means that less food is taken than when the bottle is given. It is often very difficult to give a baby of this age enough food unless it will take the bottle.

FOOD FOR THE SECOND YEAR

A child should have four or occasionally five feedings in 24 hours during the second year. Nothing but water should be given between his meals.

A child should be taught to drink from a cup after the twelfth month. Usually, however, he will take less milk from a cup than from a bottle. The use of the bottle should be entirely discontinued by the time the baby is 18 months of age.

The 10 o'clock evening feeding may be given up by 12 months if the child sleeps until 6 o'clock in the morning. Generally babies will wake earlier if not given one night feeding. The night feeding may be continued until 18 months without harm to the child.

Milk—No child needs more than a quart of whole milk in 24 hours. Less than 1½ pints daily does not assure an adequate allowance of lime for bones and teeth.

Starch and Sugar—Cereals, which are largely starch, may be given with a spoon once or twice a day. Farina, cream of wheat, and oatmeal are good cereals for young children. These must be cooked thoroughly and oatmeal may have to be strained if it loosens the bowels. Stale bread, toast, or home-made zwiebach are better for a child than bought crackers or zwiebach. These are often insufficiently baked or made of inferior materials and may contain too much sugar, bran, or shortening. After sugar is no longer given in the milk, a little may be given advantageously daily either on the cereal or in the dessert or as lump sugar at the end of the meal. Sweets between meals are bad for teeth and "tummies."

Vegetables—Any of the leaf or root vegetables may be fed to babies. Peas, beans and corn should not be given to very young children. Potato is a valuable food for the older child but is one of the poorest vegetables to give a baby.

Potato contains much less mineral and vitamin material than the green vegetables and should be considered as a starchy food. For the young child's diet, starch is supplied better by cereals, bread, or rice, since potato starch, probably because of the size of the starch granule, is more difficult to digest than any other form of starch.

Spinach, or other greens, cabbage, carrot, turnip and string beans are the best vegetables to use for young children. A good combination is to use one leaf and one root vegetable together. From 6 months of age throughout childhood, these vegetables should be given at least once a day.

How to Give Vegetables—To prepare vegetables, clean, dice and cook them in as little water as possible in an *uncovered* sauce pan. The water in which vegetables are cooked contains a considerable amount of mineral and vitamins and should be used with the pulp. For babies under six months of age the strained water may be used alone. After this age the vegetable should be put through a fine wire sieve and pulp and liquid fed together. As soon as a child is taking a considerable amount of vegetable, or at any time in the last half of the first year, the vegetables may be given best in the form of a thick soup, either purée or unstrained. This soup gradually should form the chief part of the mid-day meal during early childhood.

How to Make Vegetable Soup—One-half cup of each of two or more diced vegetables such as carrot, spinach or cabbage, and turnip with the addition of a little celery or onion if desired, are cooked until soft in enough water to cover. The root vegetables, even if diced, take longer to cook than leaf vegetables and should be started first. Spinach may become bitter when cooked more than 15 to 20 minutes. When the vegetables are nearly done, 1 to 2 tablespoonfuls of rice, which should be soaked in warm water while the vegetables are cooking, is added. The mixture is then cooked until the rice is soft which should be within twenty minutes.

A soup bone, or from one-half to one cup of ground beef, may be cooked with the vegetables. During the first three years children can be nourished adequately without meat provided milk and eggs are included in their diet. Beef, however, furnishes more iron than any other food and makes a valuable addition to the diet.

This soup may be kept from three to four days, except in hot weather, if the entire quantity is heated to the boiling point every day and is kept in a cold place.

Some Uncooked Food—Cooking and keeping is apt to change the vitamin value of the food. For this reason, fresh fruit juice is given to the infant. Fresh fruits or uncooked vegetables such as tender pieces of lettuce, celery, cabbage or carrot should be included in every child's daily food. Uncooked vegetables or fruit should be scraped or chopped fine for the young child.

Fruits—Fresh fruit pulp such as that of oranges or apples, or any cooked fruit such as stewed prunes or stewed apples, should be given during the second year. Cooked fruit may be strained but should gradually be given unstrained for its laxative effect. Stale or green fruit is dangerous for young children.

When to Give Eggs—At any time after 2 months, give the child a taste of egg yolk. If he is made ill, as shown by vomiting or hives, do not repeat for at least one year. Occasionally eggs are not easily digested, and they may even cause serious symptoms. If the egg agrees with the child, beat half a yolk well with the egg-beater and add raw to the first milk given in the morning or to the vegetable soup. Later in the first year an entire yolk may be given once a day. In the second year the whole egg may be tried, preferably coddled (soft boiled) or as custard.

MEALS—SECOND YEAR

Breakfast at 6 a. m.—Warm milk, 8 to 10 ounces; or warm milk, 6 to 8 ounces, diluted with two ounces thick barley gruel. One-half slice of dried bread or toast should be given. One-half or 1 well-beaten raw egg yolk may take the place of 1 ounce of milk in the bottle if the egg agrees with the child or the egg yolk may be added to the soup given later.

At 9 a. m.—The juice of one-half to one orange either diluted with a little boiled water, or the entire orange pulp fed with a spoon, or one-half a scraped raw apple.

Mid-morning Luncheon at 10 a. m.—Two to three tablespoonfuls, well-cooked farina, cream of wheat or oatmeal. Over this pour milk from the top of the bottle feeding.

One level teaspoonful of sugar may be given with the cereal, if more palatable. Give the remainder of the bottle feeding or from 6 to 8 ounces of warm milk, diluted with 2 ounces of thick barley gruel, after the cereal is eaten.

Dinner at 2 p. m.—Four to 6 ounces of thick vegetable purée or unstrained vegetable soup either made with rice or served with bread crumbs. The soup may be made with meat (see page 10) or an egg yolk may be added to it before serving.

Four to 6 ounces of warm milk, or milk diluted with gruel.

Supper at 6 p. m.—Eight to ten ounces of warm milk or milk and gruel, and one-half to 1 slice of dry bread.

Feeding at 10 p. m.—Eight to ten ounces of warm milk or milk and gruel. This feeding may be given up at any time according to the nutrition and sleeping habits of the child.

MEALS—THIRD YEAR

Breakfast at 7:30 a. m.

Fresh fruit juice or pulp, or stewed fruit.

Dish of cereal with top milk, with or without a little sugar.

Glass of milk and piece of toast or dried bread.

Dinner, 11:30 to 12 a. m.

Small bowl of thick vegetable soup, or vegetable and meat soup, or small amount finely divided beef, chicken, lamb, liver or coddled egg, with 2 tablespoonfuls of boiled spinach, cabbage, green beans, carrot or turnip well-mashed.

Piece of bread and butter, or bread and jelly.

Apple sauce, stewed prunes or peaches.

Glass of milk.

Light Luncheon, 2:30 p. m.

Orange or an apple, or a glass of milk.

Most well children do better at this time on three meals a day without this luncheon.

Supper, 5 to 6 p. m.

Cereal and milk, or

Bread and milk, or

Milk toast, or

Milk, coddled egg (if not given at another meal), and bread and butter, or

Vegetable milk soup and bread and butter.

Three hearty meals a day should furnish all the food any healthy child needs. The habit of lunching between meals is undesirable.

MEALS—FOURTH TO TENTH YEAR

Breakfast, 7:30 a. m.

Orange or apple, or stewed prunes.
Dish of well-cooked cereal with very little sugar.
Soft boiled egg or bacon.
Glass of milk.
Bread and butter or toast.

A Quart of Milk a Day Keeps the Doctor Away

Dinner, 12:30 p. m.

Soup of meat and vegetables, free from fat, or a serving of beef, lamb, mutton, liver, chicken, or fresh fish.

Choice of well-cooked spinach, carrots, turnips, celery, squash, beets, cabbage, cauliflower, peas, onions and asparagus. Fresh vegetables are preferable to canned ones; they should be boiled and then creamed or mashed with small amount of butter.

Choice of potatoes, either white or sweet, rice, well-cooked macaroni, or hominy grits.

Bread and butter.

Dessert—fresh, stewed or baked fruits, custard, junket, rice, tapioca, or bread pudding, charlotte russe, simple ice cream, sponge cake, or simple home-made cookies.

Supper, 5:30 p. m.

Choice of milk toast and cocoa made with milk and a very small amount of cocoa, or milk or
Cereal and milk, or
Bread and milk, or
Crackers and milk, or
Soft-boiled egg, bread and butter, and milk.

Vegetable salad with simple oil dressing or cooked green vegetable.

Stewed fruit, simple custard, or junket dessert, with or without sponge cake or cooky.

THE CHILD'S DIET

Food for children should be simple, well cooked, and attractively served. Any child eats more when his meals are appetizing. Plain food is more easily digested and more quickly available for body use.

The *quantity* of food taken should be divided nearly equally between the three meals. No one meal can be safely slighted. An inadequate breakfast usually means the child is getting too little food.

The heartiest food should be given to young children at noon if possible. A simple supper, because it is easily digested, promotes quiet sleep.

The *quality* of a child's diet is more important even than sufficient *quantity* of food. Only certain foods can be built up into body tissue or promote growth. Therefore the selection of food cannot be left to chance if the best growth of body and mind is to be insured.

THE DAY'S FOOD.

For every child the following foods should be included in the daily diet:

At least one and one-half pints of milk. A quart is better. This includes the milk used in cooking and one glass with each meal.

Some *raw fruit or vegetable preferably twice daily.*

A liberal serving of a cooked green vegetable once or twice a day.

A serving of egg or meat (or fish) or meat soup once a day. In addition to meat at dinner, older children need *an egg or a meat substitute at one other meal.*

These are the foods furnishing the tissue building material (proteins, minerals and vitamins). Besides these, to furnish energy for work and play, every child needs at every meal:

Bread with butter as a spread.

Either *breakfast cereal, or potato, rice, macaroni, or hominy grits.*

The coarse fiber of fruits and vegetables and whole cereals promotes the normal activity of the bowel.

Plenty of water between meals keeps the organs well flushed.

A child's food is more acceptable if *some simple sweet* is included in the form of sugar, honey, jelly, jam, or sweet desserts. Sweets are better given at the end of the meals.

Meals should be at regular hours, and time should be allowed, so that the food may be eaten without hurry and sufficiently chewed. The development of the teeth depends on the character of the diet and upon mastication. Some hard food, such as bread crusts, improve the character of the teeth.

A well child should eat what is put before him, and he will do so if he has been properly trained. The right food habits have to be started in infancy and insisted upon throughout the life of the child.

Most food dislikes have been suggested to the child by the parents or at least made permanent by the yielding of the mother to the whims of the child. A young child is very suggestible, and it is important that he hears the right suggestions.

If a child lacks appetite or refuses to eat well chosen and well cooked meals, look over the other important health needs, such as these:

Plenty of sunshine and fresh air, outdoors and in the house.

An early bed hour and the opportunity for 10 to 12 hours of quiet unbroken sleep.

Some rest in the daytime, a nap or periods of complete relaxation for every young child.

Outdoor play but not in excess of the child's strength.

Lack of any of these may keep a child from eating well or gaining normally.

Eating between meals, nervous excitement or anxiety, too much or too hard exercise, or defects such as decayed teeth, diseased tonsils or adenoid growths in the nose may be at the bottom of the child's distaste for his meals.

A child who, without reason, will not eat a meal is probably a sick child and should be put to bed until health is restored.

FORBIDDEN FOODS FOR YOUNG CHILDREN

Even if the child under 6 years of age can digest these articles of diet, their digestion takes longer and is more difficult than that of simple food. Rich or highly flavored food spoils the appetite for plain meals. Also such foods take the place of the parts of the meal which are essential for growth.

Meats—Canned or dried beef; salt or canned fish; duck and goose; all pork, except crisp bacon; sausage. Meat should be boiled or baked, not fried.

Vegetables—All fried vegetables; cucumbers; green corn, dried beans and peas, except when put through a strainer and served as soup; pickles, both sour and sweet.

Breadstuffs—All hot breads or fresh cake; rich cake, cakes with nuts or dried fruits; griddle cakes and waffles.

Cereals—All partially cooked cereals. Dry, or so-called package cereals, usually have less nutritive value per bulk than cooked cereals and should not be given exclusively.

Drinks—Tea, coffee, rich cocoa or chocolate, cider, soda water or any "soft" drink.

Desserts—Rich preserves or puddings; pies, pastry; salads, except with plain oil dressing; nuts and rich candy; simple candy, except at meals.

Fruits—All green, half-ripe, or over-ripe fruits; bananas unless the skins are brown, and then only with meals. Large helpings of any fruits with seeds.

IS YOUR CHILD THE RIGHT HEIGHT AND WEIGHT FOR HIS AGE?

Height and weight tables enable one to compare the height and the weight of an individual child with the average height and the average weight for height of children of similar age.

Height for Age

The average height for a given age is not to be taken as an ideal height for that age. It should be remembered that about half of the children on which the average is based are shorter than the average, about half are taller. In general, it is an indication of good health if a child of a given age has a greater stature than the average for his age. On the other hand, no anxiety need be felt if a child is below the average stature for his age, if this is not much more than the probable deviation for his age. (See Table I).

Table I.—Probable Deviation in the Stature of an Individual from the Average for His Age at Various Age Periods.[1]

Boys		Girls	
Age period	Probable deviation in stature	Age period	Probable deviation in stature
1st and 2nd years	1 inch	1st and 2nd years	1 inch
3rd, 4th, 5th and 6th years	1¼ inches	3rd, 4th, 5th and 6th years	1¼ inches
7th, 8th, 9th and 10 years	1½ inches	6th, 7th, 8th and 9th years	1½ inches
11th and 12th years	1¾ inches	10th and 11th years	1¾ inches
13th and 14th years	2 inches	12th, 13th and 14th years	2 inches
15th and 16th years	2½ inches	15th and 16th years	1¾ inches
17th and 18th years	2 inches	17th and 18th years	1½ inches
Adult	1¾ inches	Adult	1¼ inches

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[1] Compiled by C. R. Bardeen, M. D., from the U. S. Children's Bureau, "Statures and Weights of Children Under Six Years of Age," by R. M. Woodbury, on the data of W. T. Porter on "Growth of St. Louis Children," on the Boas-Burk data for the school period, "Growth of Children in Height and Weight," and on University of Wisconsin data, army statistics, and life insurance statistics for adults. Figures are given to the nearest ¼ inch.

The amount of the probable deviation from the average stature for a given age increases during childhood, is greatest about the time of puberty, and is less in the adult than in adolescents.

Weight for Height.

Weight is best considered in relation to stature. For a given stature the average weight may be determined and then the weight of any child may be compared with this average.

The average weight for a given stature is not necessarily the ideal weight for that stature. Some individuals are naturally slender and long legged, others stocky and short legged. The latter are relatively heavier than the former. However, such racial and family characteristics of build and growth are not the only influences which affect the height and weight of a child. Good hygienic conditions, especially plenty of food and sleep, promote rapidity of growth during childhood and influence the final stature and development of the adult.

Although malnutrition may be found in a few cases where children are a good stature for their age and good weight for height, any child deviating much beyond the allowance for his age in either stature or weight for stature should be carefully studied to determine what possible conditions in food, health habits, physical activities, or the home or school environment may be adversely affecting his health.

Exceptionally tall children may have a weight lower than the average for their stature and nevertheless be perfectly healthy and well nourished. Care is needed in such cases to prevent over exertion and to provide the right kind of food and environment to enable the child to meet the extra demands for body growth.

As a rule no concern need be felt if a child weighs more than the average for his stature unless his weight is excessive. In such a case, attention should be paid to the diet, and medical treatment may be needed.

In general from infancy on an older child tends to weigh more than a younger child of the same stature, but differences in weight for stature due to age are relatively insignificant from infancy to adolescence. It is important, therefore, to compare weight relative to stature rather than to age during childhood. The age and weight of any child may be compared with the age and weight opposite his stature on Table II. The probable deviation in weight is given here, and the probable deviation in stature will be found in Table I.

Table II.—Average Stature for a Given Age, Average Weight Without Clothes for a Given Stature.[2]

Boys			Stature inches	Girls		
Age	Average weight for height	Probable deviation pounds		Average weight for height	Probable deviation pounds	Age
Birth	5⅓	⅓	17	5⅓	⅓	Birth
Birth	6	½	18	6	½	Birth
Birth	6⅔	½	19	6⅔	½	Birth
Birth	7½	½	20	7½	½	Birth
Birth	8¼	½	21	8¼	½	Birth
Birth	9	¾	22	9	¾	Birth
1 mo.	10½	1	22	10½	1	1½ mo.
2 mo.	12	1	23	12	1	2½ mo.
3 mo.	13½	1¼	24	13¼	1	3½ mo.
4 mo.	15	1¼	25	14¾	1¼	5 mo.
5 mo.	16½	1¼	26	16¼	1¼	6 mo.
7 mo.	18	1¼	27	17¾	1¼	8 mo.
9 mo.	19½	1¼	28	19	1¼	10 mo.
11 mo.	20¾	1½	29	20¼	1½	13 mo.
14 mo.	22	1½	30	21¼	1½	15 mo.
17 mo.	23¼	1½	31	22½	1½	18 mo.
20 mo.	24½	1½	32	23¾	1½	21 mo.
23 mo.	25¾	1½	33	25	1½	24 mo.
26 mo.	27	1¾	34	26½	1¾	28 mo.
30 mo.	28½	1¾	35	27¾	1¾	31 mo.
34 mo.	29¾	1¾	36	29	1¾	35 mo.
38 mo.	31	1¾	37	30¼	1¾	40 mo.
42 mo.	32½	1¾	38	31¾	1¾	44 mo.
47 mo.	33¾	1¾	39	33	2	49 mo.
52 mo.	35¼	2	40	34½	2	54 mo.
57 mo.	36¾	2	41	36	2	59 mo.
63 mo.	38½	2	42	37½	2	65 mo.
68 mo.	40	2	43	39¼	2¼	70 mo.
6 yrs.	41¾	2¼	44	41	2¼	6¼ yrs.
6½ yrs.	43½	2¼	45	42¾	2¼	6¾ yrs.
7 yrs.	45½	2½	46	44¾	2½	7¼ yrs.
7½ yrs.	47½	2½	47	46¾	2¾	7¾ yrs.
8 yrs.	49¾	2¾	48	49	3	8¼ yrs.
8½ yrs.	52	2¾	49	51¼	3¼	8¾ yrs.
9 yrs.	54½	3	50	53¾	3¼	9¼ yrs.
9½ yrs.	57	3¼	51	56½	3½	9¾ yrs.
10 yrs.	60	3¼	52	59¼	3¾	10¼ yrs.
	63	3½	53	62½	4¼	10½ yrs.
11¼ yrs.	66	3¾	54	65¾	4½	11 yrs.
	69½	3¾	55	69½	4¾	11½ yrs.
12¼ yrs.	73	4	56	73¼	5¼	12 yrs.
	76¾	4¼	57	77½	5¾	12½ yrs.
13¼ yrs.	80¾	4½	58	81¾	6¼	12¾ yrs.
	84¾	5	59	86½	7	13¼ yrs.
14 yrs.	89¼	5¼	60	92	7¼	13¾ yrs.
	93¾	5¾	61	97½	7¾	14½ yrs.
	98½	6	62	103¾	8¼	15¼ yrs.
15 yrs.	103½	6¼	63	113	9	16 yrs.
	109	6½	64	117	9½	16 yrs.
16 yrs.	114½	6¾	65	121	9¾	16 yrs.
	120½	7¼	66	124	10	16 yrs.
17½ yrs.	127	7½	67	128	10¼	16 yrs.
18 yrs.	133	8	67	....	....	....
18 yrs.	137	8¼	68	....	....	....
18 yrs.	141	8½	69	....	....	....
18 yrs.	145	8¾	70	....	....	....
18 yrs.	149	9	71	....	....	....
18 yrs.	153	9¼	72	....	....	....
18 yrs.	157	9½	73	....	....	....

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[2] Compiled by C. R. Bardeen, M. D., from the data of R. E. Scammon, R. M. Woodbury, Boas and Wissler, and on Madison (Wisconsin) school children. Weights are given without clothes and allowance must be made for weight of clothing, if a child is not weighed stripped.

Owing to the difficulty of accurately measuring an infant, the average weight of an infant at each month of the first year as given in Table III is often used for an estimate of normal growth. Short babies will tend to weigh less than the average for a given age.

Table III.—Average Weight of Infants for the First Twelve Months After Birth.[3]

Age, months	Boys		Girls	
	Weight pounds	Probable deviation pounds	Weight pounds	Probable deviation pounds
Birth	7½	¾	7¼	¾
1	10	1¼	9½	1¼
2	11¾	1¼	11	1¼
3	13¼	1½	12½	1¼
4	14¾	1½	13¾	1½
5	16	1½	14¾	1½
6	17	1¾	15¾	1½
7	18	1¾	16¾	1½
8	18¾	1¾	17½	1½
9	19½	1¾	18¼	1½
10	20	1¾	18¾	1½
11	20½	1¾	19¼	1¾
12	21	1¾	19¾	1¾

[3] Compiled by C. R. Bardeen, M. D., from the data of R. E. Scammon and R. M. Woodbury. Round numbers are used.

How Growth Needs Are Supplied

Every mother should know at least which foods are able to build up body tissue and hence are essential for growth, and which foods can supply only energy for work or play. Body building foods can also serve as energy foods but this is not an economical use of food either for the purse or for the wear and tear on body organs.

To build up new body tissue—blood, bone, brain and muscle—we must have in the diet an abundance of animal protein, a variety of minerals and vitamins. Children are building every year pounds of new tissue,—from 5 to 15 pounds according to the age period. Adults do not have to grow, but they must have some body building foods in their diet to replace worn out tissue and to keep in good health.

Pregnant and nursing mothers have to have a diet rich in growth foods to supply the infant with tissue building material. Good teeth, straight bones, firm muscles, red blood, well-developed brains and bodies can not be made unless there is the right choice as well as the right amount of food.

When children take an abundance of milk, green vegetables and fruit, the growth needs are usually fully supplied. Plenty of food for bulk, such as bread, potato, and the cereals and the coarse foods for roughage have also to be included in the diet to furnish enough food for body activity.

"Filling" foods can not replace growth foods. The tables on pages 21–23 have been compiled so that mothers may have accurate information as to the real growth value of the common foods found in the American home.

Table IV.—Tissue Building Foods.

Foods furnishing ½ oz. (14 grams) protein*

Animal protein	Vegetable protein
1 pint of milk	3 cups cooked cereal
2 eggs	5 potatoes
¼ cup (2 oz.) cottage cheese	6 slices of bread
2¼ oz. lean beef or fish	1 cup (2 oz.) pea puree
	1 large cup baked beans
	3 tablespoonfuls (45 gms.) peanut butter

PROTEIN REQUIREMENT.**

1.4 to 1.8 gram protein per lb. body weight in artificially fed infants up to 1 year of age.

1 gram per lb. body weight at 6 years of age.

An infant takes practically all its protein in form of animal protein. During childhood at least *60* per cent of the protein must be of animal origin.

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*Adapted from K. Blunt, "Food and the War."

**Adapted from L. E. Holt, "Food, Health and Growth."

MINERALS

The chief minerals that have to be considered in the diet are calcium and iron. So much lime is needed in the formation of bones and teeth and other body tissues, and it is so important to have the right percentage of iron in our blood, that it is not safe to leave to chance whether or not our children have a sufficiency of these substances in their diet. It is practically impossible to furnish anywhere near enough calcium for the needs of a growing child unless a pint of milk is given daily. The best use of calcium is found when a quart of milk is taken.

The foods furnishing the largest amount of calcium and iron are given in Table V. When there is enough calcium and iron in the diet there is practically sure to be the needed supply of the other minerals used in building the body.

Table V.—Foods Richest in Minerals From Chemical Analysis.*

(Animal experimentation still incomplete.)

Calcium

Source	Measure of portion	Calories	Gram of the mineral
Milk	1 cup (8 ounces)	170	.26
Orange	1 very large	100	.10
Cauliflower	½ cup, cooked	25	.10
Celery	½ cup, raw	25	.10
Spinach	½ cup, cooked	25	.07
Carrots	½ cup, cooked	25	.04
Egg	1 medium size	70	.03
Boston brown bread	2 small slices	100	.02
Prunes	4 or 5	100	.018
Oatmeal	⅔ cup, cooked (thick)	100	.017
Iron			
Spinach	½ cup, cooked	25	.0033
Beef, lean	2½ ounces, uncooked	100	.0032
Beef juice	1 ounce	6	.0019
Egg yolk	1 medium size	50	.0015
Potato	1 medium size	100	.0015
Graham bread	2 small slices	100	.0013
Oatmeal	⅔ cup, cooked (thick)	100	.0009
Prunes	4 or 5	170	.0009
String beans	2 heaping tablespoonfuls	25	.0005
Milk	1 cup (8 ounces)	100	.0005
Orange	1 very large size	100	.0004
Lettuce	¼ head lettuce	10	.0003
Orange juice	½ cup	50	.0002

*Adapted from H. C. Sherman, "Chemistry of Food and Nutrition."

VITAMINS

A great deal is written nowadays about substances called vitamins in our food. Not very much is yet known about their exact nature. It is proven that there are at least four different vitamins, and that if any one of them is not supplied in sufficient quantities normal growth and development is interfered with and if any one of them is absent a specific disease will result.

Vitamin A is soluble in fat and is found specially in butter fat, egg yolk, fish fat, certain animal fats and organs, and in green leafy vegetables. Plant oils have not been found to have an appreciable amount of this vitamin. A serious eye disease results if it is excluded from the diet.

Vitamin B is distributed widely in many foodstuffs. It is found in whole cereals and vegetables and fruits. Milk is low in this vitamin, and none is present in pure sugar, starch, de-

Table VI.—Relative Amounts of Vitamins and Protein in Investigated Foods Used For Children.*

Source	Vitamin A	Vitamin B	Vitamin C	Protein
Dairy Products—				
Milk, fresh whole	Rich	Good	Fair to poor	Excellent
Milk, condensed	Rich	Good	Fair to poor	Excellent
Milk, evaporated	Rich	Good	Poor	Excellent
Milk, dried whole	Rich	Good	Fair to poor	Excellent
Milk, dried skim	Doubtful	Good	Fair to poor	Excellent
Skimmed milk	Doubtful	Good	Fair to poor	Excellent
Buttermilk	Doubtful	Fair	Fair to poor	Excellent
Butter	Rich	Little	Deficient	Deficient
Cheese	Good	Little	Unknown	Good
Cream	Rich	Fair to poor	Little	Little
Cottage cheese	Poor	Little	Unknown	Good
Meats and Fish—				
Meat muscle	Deficient	Little	Little	Excellent
Liver	Good	Good	Fair	Excellent
Kidney	Good	Good	Little	Excellent
Fish	Deficient	Poor	Deficient	Excellent
Eggs—				
Whole egg	Good	Fair	Poor	Good
Egg white	Poor	Poor	Poor	Good
Egg yolk	Rich	Fair	Poor	Good
Fruits—				
Apples	Poor	Poor	Poor	Little
Bananas	Little	Little	Poor	Little
Grapefruit	Unknown	Good	Good	Little
Grapes	Uuknown	Poor	Poor	Little
Grape juice	Unknown	Poor	Poor	Little
Lemon juice	Unknown	Good	Rich	Little
Limes	Unknown	Poor	Poor	Little
Orange juice	Poor	Good	Rich	Little
Pears	Unknown	Poor	Unknown	Little
Prunes	Unknown	Poor	Deficient	Little
Raspberries	Unknown	Unknown	Rich	Little
Vegetables—				
Asparagus	Unknown	Rich	Unknown	Little
Beans, kidney	Unknown	Rich	Unknown	Poor
Beans, navy	Unknown	Rich	Deficient	Poor
Beans, string, raw	Good	Good	Good	Little
Beets	Poor	Poor	Unknown	Little
Cabbage (Cooked 20 minutes)	Fair	Good	Fair	Little
Cabbage, raw	Fair	Good	Rich	Little
Carrots, raw	Good	Good	Good	Little
Carrots, cooked	Good	Fair	Poor	Little
Cauliflower	Poor	Good	Poor	Little
Celery	Unknown	Good	Unknown	Little
Chard	Good	Fair	Unknown	Little
Dandelion greens	Good	Fair	Poor	Little
Lettuce	Good	Good	Rich	Little
Onions	Unknown	Good	Good	Little
Parsnips	Deficient	Good	Unknown	Little
Peas, green	Good	Good	Poor	Poor
Potatoes, sweet	Good	Fair	Unknown	Little
Potatoes, white, (Boiled 15 minutes)	Little	Fair	Fair	Poor, little
Potatoes, white (Boiled 1 hour)	Little	Fair	Poor	Poor, little
Rhubarb	Unknown	Unknown	Fair	Little
Rutabaga, raw	Little	Good	Rich	Little
Spinach, raw	Rich	Rich	Good	Little
Squash, hubbard	Good	Unknown	Unknown	Little
Tomatoes, raw	Good	Rich	Rich	Little
Tomatoes, canned	Good	Rich	Rich	Little
Turnips	Deficient	Good	Unknown	Little
Grains—				
Barley, whole	Poor	Good	Deficient	Fair
Bread, white, water	Doubtful	Little	Deficient	Poor
Bread, whole wheat	Poor	Good	Doubtful	Good, little
Corn, white	Deficient	Good	Deficient	Poor
Corn, yellow	Fair	Good	Deficient	Poor
Oats	Deficient	Good	Deficient	Poor
Rice, polished	Deficient	Deficient	Deficient	Poor
Rice, whole	Poor	Good	Deficient	Fair
Wheat, whole	Poor	Good	Deficient	Good, little
Sugars and Starches—				
Honey	Absent	Poor	Absent	Deficient
Starch	Absent	Absent	Absent	Absent
Sugar	Absent	Absent	Absent	Absent

*Adapted and extended from "The Vitamins," Sherman and Smith, by Helen T. Parsons.

natured cereals, such as milled flour or polished rice, or in fat. A deficiency of this vitamin causes a disease of the nervous system called beri-beri.

Vitamin C, like Vitamin B, is soluble in water. It is found in abundance in certain fruits and vegetables, such as lemons, oranges, tomato, or raw cabbage, rutabaga or lettuce. Apples and prunes are too low in this vitamin to serve as a satisfactory source. Scurvy follows a diet low in Vitamin C.

Vitamin D is found specially in cod liver oil, and to a less extent in egg yolk and in butter. The disease called rickets, which is an improper calcification of bone, may result when too little of this vitamin is given to children. It is probable that in the winter time, where it is impossible to be daily in the direct sunshine for any considerable period, all infants, whether nursing or artificially fed, should be given cod liver oil. This may be begun in half teaspoonful doses after feeding once or twice a day and should be increased to 1 teaspoonful twice a day. In this way deformities such as bow legs and knock knees can be prevented.

Any child taking an abundance of food may fail to grow because the vitamins in the food are not present in sufficient amount. Long before a specific disease occurs, indefinite but none the less serious weakness and lowered resistance to infectious diseases follow a low vitamin diet.

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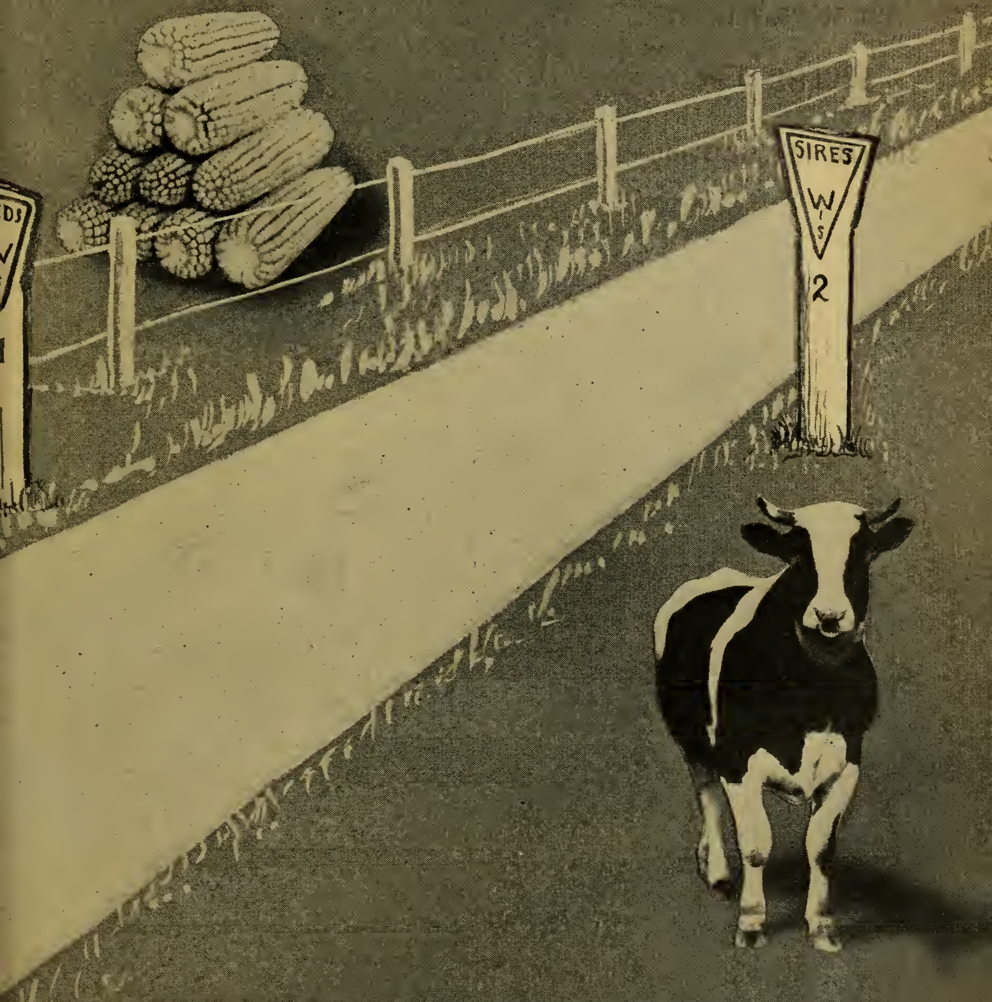
MILEPOSTS ON THE ROAD TO MARKET



ANNUAL REPORT OF THE EXTENSION SERVICE
OF THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN, MADISON

Average or Above Average?

HOW much is it worth to Wisconsin to be above the average? Here is one answer. The average cow produces 5,000 pounds milk; the cow-testing association cow nearly 7,000 pounds. A difference of 2,000 pounds!

* * * *

INFORMATION is the basis of the above the average. There is enough information and knowledge in the libraries and laboratories of experiment stations to revolutionize farming.

* * * *

BY READING, by observation, by conversation, and by expensive self-trial we secure information. This requires interest on each man's part in being above average.

* * * *

WISCONSIN is above the average—and wants to lead the above-the-average states. This report gives some facts about building above the average.

* * * *

RESOLVE in 1924 to be—
"Above the Average"

Mileposts on the Road to Market

H. L. Russell and K. L. Hatch

THE MERCHANDISING of farm products begins with the selection of seeds and sires. There is no doubt about this statement. It is not debatable. Neither is it possible to separate production from marketing. The one implies the other. Since marketing presupposes something to sell that is worth selling, it is evident that the product must have *quality* and *merit*. There are but two classes of farm products. The one is derived from plants—the other from animals. The quality of the former is dependent upon seed stock; that of the latter upon kind of sire used. It is useless to try to develop a market for "mongrel" crops. It is destructive to agriculture to deal in "scrub" stock. Both roads lead to disaster. The future of American agriculture cannot rest secure on such a foundation of sand. The popular cry, "We know enough about production, now give us a better marketing system," must not be interpreted literally. *We know altogether too little about producing to meet market demands.* We do not need less production effort, but more effort to produce what will appeal to the demands of the market. In our present efforts to "solve the marketing problem" we must not overlook the fact that the road to the farm market begins at the first milepost—"the selection of seeds and sires."

Farmer Controls Quality

The only monopoly which the farmer has or can have is the absolute control of the quality of his product. But the control of quality is a production problem—the first step in merchandising. For the larger production enterprises, such as the manufacture of butter and cheese, an organization is necessary. Few farmers produce in sufficient quantity to carry the burden of manufacturing costs; and an organization can always sell to better advantage than can the individual farmer. The selection of seeds and sires is largely an individual problem, but the individual will always do well to join with a group even in this.

There are at least five conspicuous signboards on the road to market. On these should be inscribed these significant "warnings" in the order named, if the producer is to realize a profit on his effort at the end of the road:

1. Carefully select both seeds and sires.
2. Safeguard the product against destructive agencies.
3. Keep down costs of production.
4. Develop necessary producing and selling organizations.
5. Supply the public—both producers and consumers—with reliable information.

This report relates a few simple stories of successful efforts to produce what the market is willing to pay for, and tells how buyers were found for these products at prices satisfactory to both producer and consumer. For it must always be kept in mind that in the last analysis the consumer establishes the price. When he quits buying the market is gone. The biggest job in marketing is to win and hold the trade.

CAREFULLY SELECT
BOTH SEEDS AND SIRES

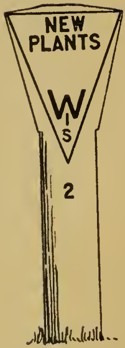
(The first signboard)

The Production and Sale of Seeds

TWENTY years ago the Wisconsin Experiment Association was organized. Its membership included only students and former students of the College of Agriculture who had learned at first hand the value of improved seed. Its purpose was to produce standard varieties in sufficiently large quantities to meet any possible market demand and to sell the resulting products at reasonably profitable prices.

Its work began where that of the experiment station left off. After new varieties of suitable high-yielding seeds had been developed by the Experiment Station this association began the active work of giving these valuable seeds the widest possible dissemination. The state-wide organization originally consisted of about 200 members. Later county orders were formed so that the organization grew to over 6,000 in membership. This association had four purposes in view:

1. To grow one or more varieties of high-quality seed.
2. To produce in sufficient *quantities* to sell carlot shipments.
3. To advertise collectively, thus reducing selling costs.
4. To sell through a central marketing agency.



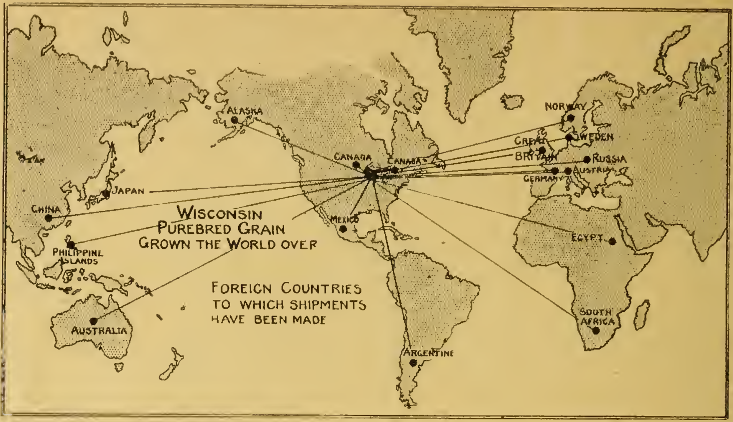
So well have its purposes been accomplished that its business has grown from an insignificant beginning the first year to a satisfactory total running into hundreds of thousands of dollars annually. Its aim has always been to please the customer both as to quality and price and at the same time to realize a profit for the grower. No sharp practices have been tolerated and prices have always been kept on these pure-bred high-yielding strains from one-half more to double those of ordinary market grades. Thus the producer usually has been able to secure a profit on his business and the purchaser for the most part has been satisfied with his purchase.

Seed grains have been shipped to all parts of the nation and the world, as shown on the accompanying map. The trade in seed grains developed by the Wisconsin Experiment Station is now one of the state's "million dollar" industries.

New Plants Make Appearance

When new plants appear, the selection of seed of the most suitable variety is always a problem. Take the case of soybeans. During the past year, 50 varieties have been subjected to test on 34 farms well distributed over the state. These plots serve the double purpose of demonstration and as a source of data to guide the farmer in his selection of seed for future crops. The soybean acreage has increased tenfold in the past five years.

Likewise, in the development of the hemp industry, similar methods were used.



Above—Wisconsin furnishes seed stock to all the continents of the earth, but she first developed GOOD SEEDS.

At left—Why does Wisconsin furnish these Holsteins for foundation stock in Idaho? The use of GOOD SIRES is the answer.

At right—SEED buyers from other states inspecting our potato fields. A good reputation for CERTIFIED SEED brings them to Wisconsin.

The Story of Hemp

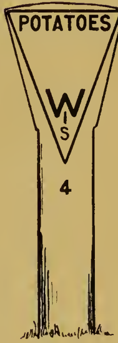
Regardless of the present unfavorable condition of the Wisconsin hemp industry, it offers a very specific example of the attention given by the College of Agriculture to both production and marketing.

To show that hemp could be grown in Wisconsin was an important accomplishment of the Experiment Station, but following that came the great problem of the development of machinery to eliminate hand methods. Consequently immediate attention was given to the development of power apparatus, and as a result satisfactory machinery was finally produced.

Simultaneously with the development of mechanical devices and cultural practices came the study of markets. Since hemp fiber is an international commodity, careful analysis of both foreign and domestic markets was made, and an organization of hemp men was formed with a representative of the college acting as secretary. The actual business of selling hemp fiber was done through the "Hemp Association." Through these efforts Wisconsin hemp fiber was thoroughly advertised and previous to the world depression our product was known wherever hemp was used.

In the spring of 1920 the world-wide economic depression began to affect the price of hemp fiber. Since then it has been impossible to obtain a profitable market on account of the dumping of foreign hemp fiber onto the unprotected American market at prices below our cost of production.

"Certified" Seed Potatoes



For the past twelve years the College of Agriculture has been engaged in developing potato growers' associations for the purpose of securing quantity production of good smooth tubers of both seed and table stock. Here as elsewhere emphasis was placed on suitable seed as the first signboard on the road to market. From small beginnings have developed large areas producing but one or two varieties of potatoes which may now be had, if need be, in million-bushel lots. From Oneida County alone, which twelve years ago was unknown as a potato-producing center, was shipped 80 carloads of a single variety of seed stock to outside markets during the past season.

Farm Visits to Individual Growers.—Farm visits for inspection and other purposes were made to 550 farms last year. Special mention is made of these visits because they develop community leadership. In each community there are individual growers who have adopted improved methods along one or more of the following lines:

1. The use of foundation seed stock for later dissemination to other growers in the same community.
2. The use of seed treatment for the control of scab and scurf.
3. The use of improved machinery and equipment, especially for spraying operations.

Educational work now in progress is directed toward the following results:

a. A greatly reduced acreage of potatoes in those sections of the state where the soil has become depleted due to long-continued potato growing.
b. A more diversified system of farming in which potato culture is associated with livestock raising and the growing of legumes and forage crops.
c. A discontinuance of commercial potato growing on farms outside the potato belts, where neither yield nor quality justify the investment required.

Community potato growing of superior strains, of adaptable varieties, based on market requirements, continues to receive especial emphasis in potato extension work in Wisconsin.

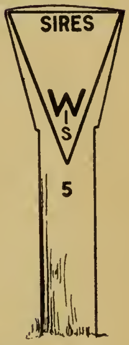
This leads to grading, standardization, marketing organizations, seed inspection, and the development of outside markets for Wisconsin seed potatoes.

Advertising and publicity methods, including the annual "potato tour," have been used to develop demand for Wisconsin Seed Potatoes. This material has reached seed-buying interests from Long Island, New York, Florida, Indiana, Alabama, Illinois, and Arkansas.

Estimates based on reliable information following the 1923 tour indicate the sale of not less than 100 cars of Wisconsin Certified Seed as a direct result of connections established through this feature alone.

That this work has been effective in first developing desirable seed and table stock and later in establishing a market for superior Wisconsin seed is proven by the fact that last year 350 cars containing 200,000 bushels of Wisconsin seed stock were sold to outside trade at prices ranging from $.80 to $1.25 per bushel while the common stock was a drug on the market.

This does not include a very large amount of seed stock entering into trade between the counties within the state, for which records are not available. Nowhere else is it more apparent that the merchandising of farm products begins with the selection of seed followed by properly safeguarding the crop, the elimination of waste in the cost of production, organization for producing and selling, and constant educational work until the product finally reaches a satisfied customer who is willing to pay a price that will yield a profit to the producer.



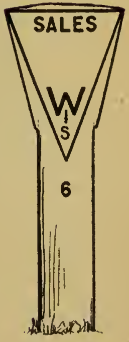
Selection of Sires and Sale of Livestock

IT IS only a short time, but seventeen years, since the first community breeders' association was organized. At that time the breeding of purebred dairy cattle in Wisconsin was yet an "infant industry." There were relatively few "grades," the bulk of Wisconsin's dairy production coming from common or native cows.

Today high-grade dairy herds may be seen on every hand and nearly 150,000 registered dairy animals of all the leading breeds are to be found within the borders of the state. While the development of dairy cattle is more marked than that of horses, beef cattle, sheep and swine, these latter have made substantial progress. Wisconsin is today looked upon everywhere as a dependable source of dairy cattle and other livestock. But why?

Because someone had the *vision* to see that this result could not be achieved with nondescript stock and had the *courage* to work and fight for this ideal.

Our present favorable livestock market was built upon the sure foundation of bred-for-production sires. In no uncertain way has the "selection of sires" become the first milestone on the road to the present favorable livestock market.

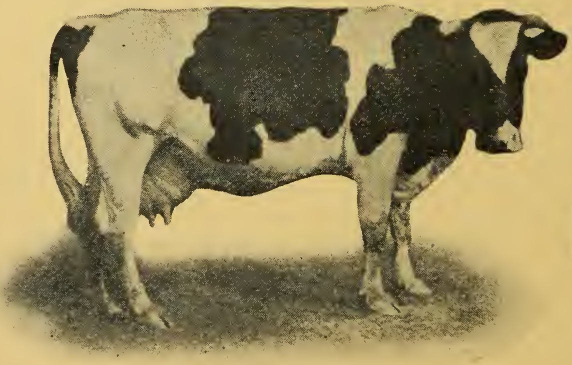


Take the experience of the past year. Wisconsin dairy cattle were shipped to 45 states in the Union, to Canada, Mexico, Porto Rico, South America, India, Africa, Australia, and far-off Japan. Her markets may truthfully be said to be world-wide.

Out-of-state buyers absorbed 42,000 head of the state's surplus dairy cattle at satisfactory prices. The value of actually knowing the producing power of dairy cows is indicated by recent sales which show that an average of approximately $30 per head higher prices were paid for cow-testing association grade cows than for those of unknown production. But in the matter of the

Top—THE DAM at 9 years produced 14,249 pounds of milk and 472 pounds of fat.

At right—THE DAUGHTER at 7 years produced 18,752 pounds of milk and 687 pounds of fat.



At left—While the GRANDDAUGHTER as a 3-year-old heifer produced 18,028 pounds of milk containing exactly as much fat as her mother (687 pounds).

Three generations, each a little better than the one before. Breeding, feeding, testing, and keeping records make profits more nearly certain.

use of better sires cow-testing association members themselves show the greatest advance; they practice what they preach. Ninety-six per cent of the bulls heading the 4,090 herds owned by members of the association are of "pure" breeding. Cow-testing association records have conclusively proven that bred-for-production sires are the best to use. It is for these reasons, widely known throughout the dairy world, that Wisconsin's dairy cattle are in strong demand. Fifty thousand head will this year arrive at the final milepost on the road to market—satisfied customers for Wisconsin dairy cattle.

This result was not attained without careful planning and vigorous and constant effort. For some years past the College of Agriculture has maintained a dairy cattle specialist for the express purpose of assisting out-of-state buyers in securing exactly the kind and class of cattle which they want. This method at one and the same time assures satisfied customers and protects the good reputation of the state. By fostering the use of better sires, by the organization of community breeders and cow-testing associations, and by actively searching out and developing markets for desirable stock Wisconsin has been placed in the forefront as a dependable source of dairy cattle.

SAFEGUARD THE PRODUCT AGAINST
DESTRUCTIVE AGENCIES

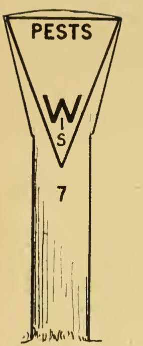
(The second signboard)

Seeds and sires are the basis of quality products. But they do not insure them. All along the road to market the product must be protected from destructive agencies, such as plant and animal diseases and field, orchard, and garden pests, which continually threaten its destruction. No matter how careful the selection of seed or the search for suitable sires, all this effort is of no avail if disease invades or pests destroy.

Checking Orchard and Garden Pests

DURING the past year, as in former ones, this type of field work has been carried on by the demonstration method.

These demonstrations consist of actual pruning in the farmers' orchards where those interested had met in response to an invitation of the county agent. In each case, several different types of



trees which require different kinds of pruning were selected. As these trees were being pruned, reasons were given for the various cuts. Where time permitted the farmers were asked to prune some of the remaining trees and small fruits under the direction of the demonstrator. The attendance at these meetings varied from 5 to 75 men, women, and school children, the average attendance being about 20 persons each.

Orchard spraying demonstrations were carried on in 82 orchards in Fond du Lac, Kenosha, Winnebago and Ozaukee Counties. Several other counties organized "spray rings" consisting of a group of a dozen or more farmers who received assistance in spraying. In these spraying demonstrations, the spray operator was coached in each of the four foliage sprays, in the preparation of the spray solution, and the proper use of the spray rod and the spray gun, so that the work was done in a thorough and effective way.

Conferences in 11 Counties

Besides the pruning and spraying demonstrations conferences were held in 11 counties. These conferences usually consisted of meeting with some farmer or fruit grower for some special recommendations on pruning, grafting, spraying and planting.

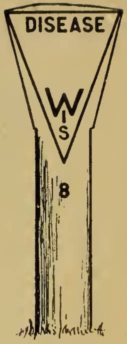
It is encouraging to note that the farmers are realizing that their work is only half done when they have produced good fruit. This was manifested in Walworth, Winnebago and Kenosha Counties where they requested apple grading and packing demonstrations so that they might *sell* their fruit more profitably and thus build up a satisfactory trade.

A single example will illustrate. Mrs. Warren near Lake Geneva was very anxious to sell her apples, some 200 bushels, in such a way that she might realize at least enough to pay for the original investment, spraying and the picking. A grading and packing demonstration was held in her orchard, after which she took these graded apples to Lake Geneva and solicited sales for them. Nearly every one of those solicited bought and promised to order more after the first lot had been sold. The selling price agreed upon was from 25 cents to 50 cents more per bushel than the prevailing price in this locality. The work has been so satisfactory that it is planned to have many more grading demonstrations during the season of 1924.

If commercial orcharding is to advance in Wisconsin, it will be through conversion of the better home orchardists, made better through this type of work, into commercial orchardists. Thus this work not only means better conditions for the home, but the development of an industry for which Wisconsin is admirably suited, but of which she has not yet availed herself in any marked degree.

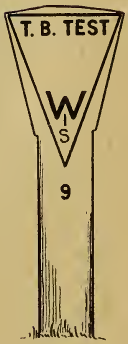
Disease Diagnosis for Veterinarians

NO PRICE basis, however high, can stand the destructive toll of animal diseases. Here the farmer, and often the veterinarian, finds himself helpless without the aid of laboratory equipment. More and more are veterinarians and farmers making use of the college laboratories for this purpose. During the past year 3,300 diseased specimens from cattle, horses, sheep, swine, poultry and other domestic animals were received by the department of veterinary science for examination. Whenever advisable field trips are made to study affected animals on the farms or to secure fresh specimens for further examination in order to assist in outlining suitable control measures.



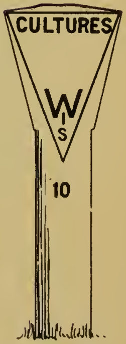
Supplying Tuberculin for the "Test"

THE "clean-up" campaign of bovine tuberculosis has now gained such momentum, after twenty years of educational work, that the only limit to its progress is the funds necessary for indemnities. The college continues to supply the tuberculin to the State Department of Agriculture in ever-increasing quantities; this year an amount sufficient for the testing of 200,000 head of cattle. Since outside buyers all insist on disease-free stock, this work has contributed greatly to the demand for Wisconsin dairy cattle.



Increasing Use of Cultures for Legumes

THE chief demand for bacterial cultures is for the inoculation of alfalfa and soybeans which this year was about 75 per cent of the 51,000 bottles of this material distributed. Though the demand for these cultures has increased year by year, as the fields of growers of these crops become inoculated, however, it does not seem probable that this demand will continue to grow indefinitely since it will be confined largely to the spread of these crops into new areas.

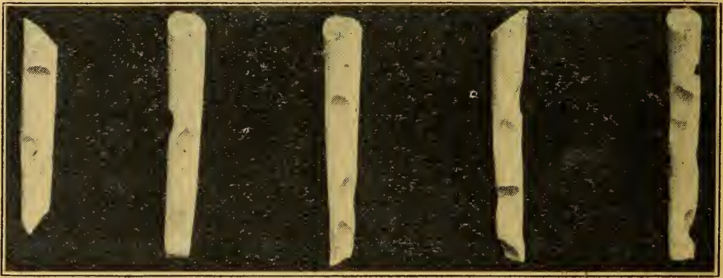


Cultures Help Control the Quality of Cheese

NOT all "germs" are harmful. The successful manufacture of Swiss cheese is largely dependent upon the kind of germs which may be present or are later introduced into the milk. In recent years it has become possible to improve the quality of this product by the clarification of the milk and the addition of the right kind of cultures which the college has supplied this year directly to 36 different factories in the Swiss cheese area. This work, carried on with the assistance of the United States De-

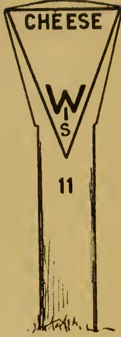
Top—A farm tour. Interested farmers learning more about the growing and handling of soybeans.

Center—One good foundation cow is better than a dozen poor ones. Beauty's Fern of Spring Brook heads this string of producers. Four are daughters, the rest, her granddaughters.



Bottom—Plugs from fancy Swiss cheese made in October from milk delivered once a day by use of cultures.

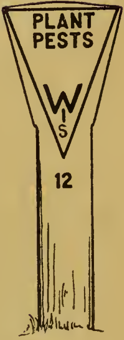
partment of Agriculture and the Southern Wisconsin Cheese Makers' Association, is already having a marked influence on both the quality and the price of cheese in this territory. The effect of the use of these cultures is well summarized in a statement from the manager of a Broadhead concern. He says: "Regarding the value of the Bulgaricus and the 'eye-forming' cultures which we have been using for about two years, we wish to say frankly that we can recommend these very highly. We do not know what we would have done here at Broadhead without them. Through the use of these cultures we are in a position to pay more for raw milk, thereby benefiting not only the farmers, but also ourselves through getting a better article."



Preventing Plant Disease

THE former policy of preventing plant disease has been continued during the past year. Special emphasis has been placed on potato disease control. Sixty field and farmers' meetings have been attended by 6,700 people.

The most important demonstrations of the year were the community potato seed treatment tanks in operation at Amherst, Almond, Blaine, Bancroft, and Custer in Portage County; Iola and Waupaca in Waupaca County, and De Pere in Brown County. These tanks were built both by the farmers and by leaders in the community at an easily accessible central point to which the potatoes are taken for treatment. Between 25,000 and 30,000 bushels of potatoes were given the disinfecting bath of corrosive sublimate needed to destroy the germs on the potato seed. Those who treated last year came back again this year and brought others with them, testifying to the value of this work.



Treated Seed Increases Yield

The experience of Henry Kollock, a farmer near Bancroft, is worth noting as typical. In 1922 he had over 500 bushels of potatoes rejected at the shipping warehouse because of scab and black scurf. This year he treated his seed stock at the new community tank, leaving two rows across a 20-acre field untreated. When the potatoes came up there was a noticeable improvement in stand where treated seed was used. At digging time Mr. Kollock figured an increase of 35 bushels to the acre on treated seed. Not only was there an increase in yield, but there was practically no scab present where treatment was used, the entire stock being smooth and salable.

On the potato field of August Michelson, Pembine, which last year showed 12 per cent mosaic, the diseased plants were pulled out and this year only 6 per cent mosaic appeared in fields from this rogued stock. On the other hand, a leading grower at McNaughton didn't believe in roguing in 1922, although 12 to 15 per cent of mosaic was present in his potato field. He maintained that he could control the disease by staking apparently healthy hills and saving seed from them. This plan was carried out and in 1923 his fields showed 25 to 30 per cent mosaic. Next year he intends to maintain an isolated field for seed production and go over it thoroughly and often to remove any mosaic plants that may appear.

Treat Seed Grain

Grain seed treatment demonstrations were conducted this year in Racine, Waupaca, Winnebago, Washburn, Ashland, and Door Counties. The method of applying the formaldehyde was of less consequence than the thoroughness with which the operation was done. The solution was applied by soaking, sprinkling, dry and machine treatment. Several machines have been purchased by groups of farmers and in this way one machine has had a wide influence in controlling grain smut in that vicinity. Waukesha, Racine and Grant Counties have particularly emphasized this type of treatment.

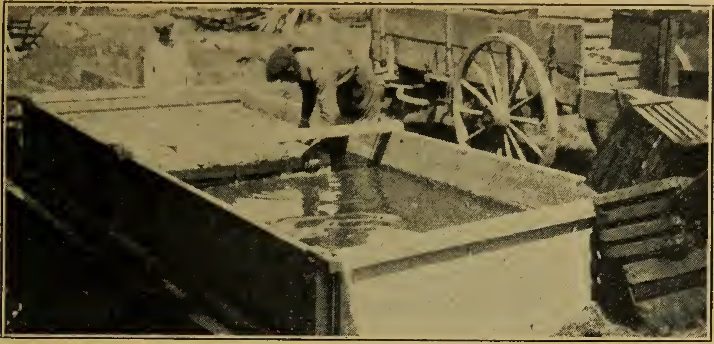
Fifty gallons of formaldehyde were used for grain seed treatment in Door County on about 16,000 bushels of oats. Results, practically no smut on oats in Door County this year.

Cabbage seed treatment demonstrations in the vicinity of Appleton and Shiocton have shown splendid results. Hardly a plant of black rot and blackleg is to be found where the seed was treated.

KEEP DOWN PRODUCTION COSTS

(The third signboard)

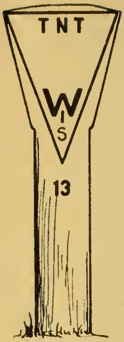
Unproductive land often eats up the profits of farming. Such land must bear its share of fences, taxes, and other charges for which it returns little or nothing to the owner. Costs of production can be materially reduced by a better utilization of farm land and by growing crops of higher value to replace those of less value. Too frequently we see highly fertile, level land growing a sparse return of cordwood timber or some cultivated crop when the actual taxes on such tracts exceed the returns secured. Clearing or drainage may bring this land into profitable production. A third signboard on the road to marketing can well bear the legend, "Keep Down Production Costs."



Above—One of the seed potato treatment tanks at work in Waupaca County.

At left—Treating seed oats with formaldehyde to control the smut in Door County.

At right—Smut treatment machine which travels round from farm to farm in Florence County.



Land Clearing Continues

WISCONSIN'S outstanding land-clearing accomplishments for 1923 are:

First, clearing of over *one hundred thousand acres* on the existing farms in northern Wisconsin where the acreage is often now inadequate to provide for efficient farm operation, and where the cleared acreage is too small to provide necessary feed for existing live stock; and,

Second, reducing the cost of operation on thousands of southern Wisconsin farms by the removal of occasional stumps and stones and the squaring-up of fields.

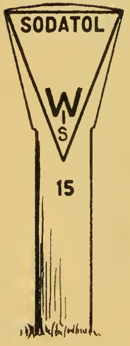
Wisconsin farmers early recognized the unusual opportunity which presented itself to them in being able to utilize the war explosives that have been salvaged by the United States government through the instrumentality of the agricultural colleges.

Picric Acid Used

The United States Department of Agriculture, in reporting on the distribution of picric acid for the last fiscal year, gives a total of 4,179,550 pounds that have been distributed for agricultural purposes in the several states. Of this amount Wisconsin received 2,614,000 pounds or 62 per cent of the entire quota distributed. The states of Michigan and Minnesota together secured 1,079,000 pounds, while seventeen other states used only 486,000 pounds.

All of this material had to be brought by long freight haul from Fort Wingate, New Mexico, entailing, therefore, a relatively high cost of 11 to 12 cents a pound principally for freight and cartridiging to lay it down in Wisconsin.

Sodatol, the New War Explosive



The next step in the use of war explosives was the introduction of sodatol, a compound of TNT and sodium nitrate. After considerable experimental work a proper mixture was found that was efficient under varying conditions. Following the investigations conducted by the department of agricultural engineering and by the United States Department of Agriculture, this material was announced to the farmers of the state on August 20, 1923. It is a significant fact that before any of the material was actually placed in the hands of the farmers, orders for 1,750,000 pounds had been received and paid for. This expenditure of cash for something they had not yet seen is the best index of the faith which the farmers of the state place in the recommendation of the institution regarding explosives for land-clearing use.

Sodatol has been distributed to Wisconsin farmers this fall at a cost of $5.95 per hundred pounds wherever carlot shipments were made. One hundred pounds of sodatol are approximately equivalent to 120 pounds of ordinary dynamite. From September to December 1, 1923, a total of 2,105,000 pounds, or 112 carloads, of this material has been ordered and distributed to about 10,000 farmers in 68 out of the 71 counties of the state.

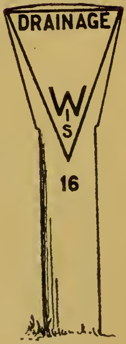
More and more the farmers in the southern part of the state are taking advantage of these cheap war-salvaged explosives for the removal of stumps and stones. About 380,000 pounds have been used in the older-developed, southern counties, while 1,725,000 pounds were used in the "cut-over" northern counties. During the season 2,000,000 blasting caps have also been distributed gratuitously with this material.

Dynamite in small quantities in the southern counties retails for approximately 25 cents or more a pound, while it rarely retails lower than 16 cents in the northern counties.

If Wisconsin farmers had purchased an equivalent amount of standard explosives at prevailing prices it would have cost them over $500,000 more than they actually paid out. Without question the cheap price of these explosives greatly stimulates their use. Stump land made productive on farms with restricted crop acreage must increase the income from such farms. It is only by securing an increased return on the total investment that unprofitable farms can be changed into profitable ones. In the long run any farm that does not yield a profit must be abandoned. Farmers on such farms will continue to "hang on," however, so long as they can meet inadequate returns by lowering their standards of living. It is this tendency to "peasantize" American agriculture that must be resisted at all hazards.

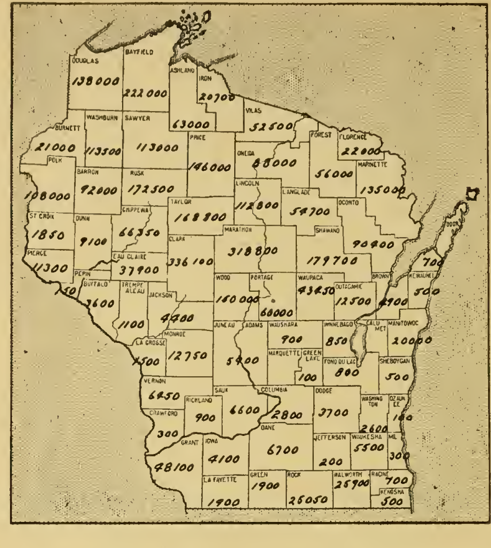
Undrained Land a Tax on Profits

UNDRAINED land is an even greater tax on farm profits than stump land because much of the low land is found on farms already heavily capitalized with livestock, buildings, fences, and other improvements. To bring such land into profitable production is often a problem for the individual farmer to solve. The organization of drainage districts and the proper installation of these systems must be met by group action.



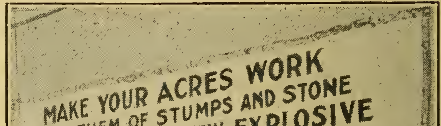
During the year just closed fourteen tile drainage systems and one with vertical drain outlets, affecting about 400 acres, have been laid out and construction supervised on farms for community demonstration.

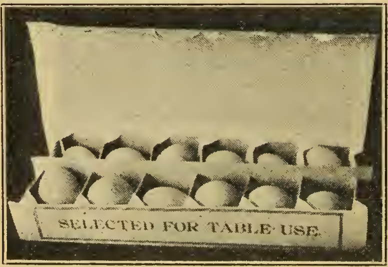
Each demonstration had a particular object in view. On the M. K. Lindsay farm at Lodi, for example, the unusual difficulty consisted of soft ground and "boiling" springs. An extra amount of time was spent on this project in helping the tiler install a good job. Farmers in the vicinity asserted that the land could not be drained. Since the springs have been dried up, four neighbors have planned and are installing tile systems. The



Top — This map shows the number of pounds of explosives (picric acid and sodatol) delivered to each county during 1923 for agricultural uses.

At right—Exhibits at fairs serve to interest large numbers in various lines of agricultural improvement. This exhibit helped to sell "sodatol."





At left—It pays to use a neat and attractive handy package because it pleases the customer.

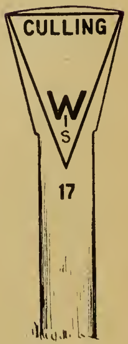
drainage habit grows from these properly installed demonstrations. Feasibility surveys were made on 24 other farms aggregating 1,330 acres.

Three drainage systems that had been reported failures were examined, the causes of failure determined, and the remedy suggested. One of these systems was 12 years old. Conditions had been materially improved, but a deep peat zone next the high land remained wet. Elevations were taken at intervals along the lines and post auger holes dug to note the position and behavior of the ground water. The farmer was advised to lay a couple of lines in this "springy" zone to a greater depth and in a position to intercept these springs. The construction work is now going on.

Seven special farmers' meetings with aggregate attendance of 225 were held in connection with the farm demonstrations. In addition to these meetings there were frequently several persons present in the field who observed methods and principles used in laying out tile drainage systems.

Drainage Districts

During the year reports were written on 17 drainage projects aggregating 56,580 acres with the estimated cost of $491,693 for the outlet drains. These projects were all examined in the field and reports made both as to soil and drainage possibilities.



Poultry Culling and Records

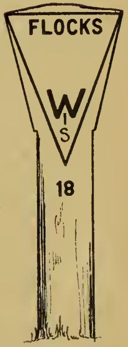
NO ONE can make poultry pay with unproductive hens any more than one can make dairying pay with unproductive cows, no matter what the price of eggs or milk.

Culling

Culling is demanded constantly and has proven itself to be necessary. During one month about 2,850 hens were handled and 950 sold as culls. The egg production did not drop after the removal of these hens because they were "star boarders." A savings of at least 150 pounds of feed per day was accomplished, which, over a period of six months, would make a considerable saving to the owners.

Demonstration Flocks

In the demonstration flocks is found the "follow-up" work for culling. Here is put into practice the suggestions that are offered for the benefit of poultry owners and serve to disseminate new methods and practices that will increase profit by lowering the cost of production.

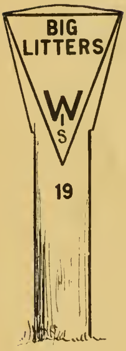


Feed Costs

As a concrete example of what has been done and can be done, rather than what is being universally accomplished, is the record of Harry Hansen at Withee in Clark County. During January the feed for 300 Single-Comb White Leghorns and Barred Plymouth Rocks cost $40.80; 4,645 eggs sold for $154.80, and the return over feed cost was $114.00. This means an average return of about 38 cents per hen over feed cost for a single month—not such a bad investment.

The Economical Production of Meat

WITH the European market demoralized and an unusually high production of meat animals it has been well-nigh impossible to produce meat at a profit. To do so, it is imperative that costs of production be kept at the lowest possible point. It is as yet impossible to say just what the cost of either beef or pork production is, but in the demonstrations carried on in eleven counties well distributed over the state the lowest feed cost for the production of 100 pounds of pork, live weight, reported was $4.04. This result was obtained by the use of rape pasture, a plentiful supply of skimmilk and a grain mixture of ground corn, ground oats and ground barley and middlings.



Ton Litters

Small litters caused by high losses at farrowing time necessitate keeping over winter a large number of brood sows. If large litters can be reared this excessive cost of pork production is eliminated. The "ton-litter contest" is designed to encourage the production of large litters. One hundred and sixty-three farmers entered this contest for the first time this year. The winner in the state contest was a litter of 14 cross-bred pigs, owned by R. Groth & Son, Ixonia, Wisconsin, which at seven and one-half months reached the combined weight of 4,570 pounds, or an average of 326 pounds each. This large size and rapid gain was made possible through the use of alfalfa pasture, combined with dairy by-products and a well-balanced grain and tankage mixture fed in a self-feeder. In addition this litter was fed all the shelled corn they would clean up.

Under present conditions profits in pork making depend upon: The production of large litters, and rapid gains made possible by the use of pasture, a good ration, and self-feeders.

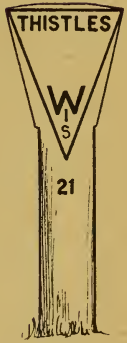
Alfalfa Eliminates Drain of Feed Bill on Farm Profits

THE weakest link in Wisconsin's chain of agricultural progress has been her inability to produce enough of the right kind of feeds for her livestock. Every year millions of dollars in the form of farm profits are paid out for costly feeds to maintain her cattle. This situation is quite largely due to the small acreage of alfalfa and clover and the large acreage of timothy. Only 11 per cent of Wisconsin's tame hay land is being utilized to grow alfalfa and clover, while 89 per cent is devoted to the growth of timothy with only a thin sprinkling of clover which is grown with it. The time has come to eliminate the heavy drain of the feed bill on farm profits, and to put more energy into lime, inoculation and other essentials. With them should be grown the crop that works hardest for us, that produces the most for us, that puts the milk into the pail and the dollars into the bank, that gives us the greatest returns in satisfaction and in soil enrichment. This crop is alfalfa. No other forage is to be compared with it.

Alfalfa Succeeds; Clover Fails

An unusual drought prevailed during the months of May and June in many parts of Wisconsin. At Madison the normal rainfall for this period is 7.72 inches, but only 4.95 inches fell—representing a deficiency of nearly 36 per cent. This put the hay crops to a real test and clover and timothy, with their comparatively shallow root systems, proved a serious failure in many places. Alfalfa, with its deep roots, made one of the most remarkable showings that the crop has ever known.

Those alfalfa growers who had old fields and even many who had new fields had their hands full and their barns full. Those with timothy and clover have empty barns and a big feed bill to face during the winter months. Alfalfa hay is now selling in excess of $30 a ton, which indicates the great scarcity of hay in the state which has resulted both from drought and a too limited acreage of alfalfa. A keen Idaho farmer recently remarked: "I cannot understand why Wisconsin farmers are willing to pay the West for growing necessary forage and the railroads as much more for hauling it when they can themselves grow it at home if they only would."



A Remarkable Canada Thistle Demonstration

In a southern Wisconsin locality where alfalfa has long been considered a failure a farmer had a patch of Canada thistles which have been with him for fifteen years. In the outset these thistles covered but a very small area, but despite several vigorous attempts at their eradication with plowing, with cultivation, and with excessive applications of manure, the thistles spread until they covered nearly half an acre.

The county agent suggested alfalfa as a cure for this pest. The idea at first seemed absurd, but he expressed a willingness to try most anything which would give promise of control of this pestiferous weed. He required that the directions for seeding the alfalfa and treating the soil were to be written down to avoid error. He was supplied with a hardy strain of seed and with the necessary advice to make alfalfa a success. The crop was seeded in 1922 and in June, 1923, a meeting was held there attended by some 75 farmers, many of whom came for long distances to see what they did not believe could be true. At this time the alfalfa had annihilated at least nine-tenths of the thistles and it was evident that it would require only another year to have the entire growth completely eradicated. Seeing is believing.

The increase in alfalfa acreage within the state during the past season due to educational work and other conditions suggested has been 62,000 acres, or 70 per cent over that of the preceding year. For our 3,000,000 head of dairy cattle we should grow at least 2,000,000 acres of this crop. It is obvious that we have scarcely made a beginning with this important crop, but each year adds to knowledge and places the successful production of this plant on a sounder scientific and practical basis.

Idle Soils Made to Produce

CAPITAL invested in land must be made to yield a return the same as any other investment. Profit comes only after expenses are paid, including interest on investment. Unproductive land may return too little to pay even interest—the first charge. Increasing the investment by addition of fertilizer or lime often increases the return from the land so that a loss is converted into a profit.

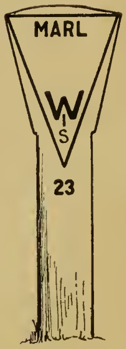
The keynote of the extension work in soils the past year has been "the necessity of maintaining soil fertility at full working capacity" by use of following fundamentals:

1. The necessity for growing legumes successfully on at least one-fourth of the tillable area of the farm each year.
2. The need for lime in some form in many parts of the state in order to be able to grow clover and alfalfa successfully.
3. The need for phosphate fertilizers on soils that have been depleted of their phosphorus supply by long-continued cropping.
4. The need for potash and phosphorus fertilizers for peat soils in southern Wisconsin.

Demonstration plots were found to be a great help in convincing the farmers of the value of lime and commercial fertilizers in soil improvement work, especially in Racine and Monroe Counties, where farm tours were conducted.

The interest in the use of the portable lime-grinding machines is growing very rapidly. There are now 40 machines located in 19 counties in the state. Present indications are that there will be a dozen or more machines purchased this coming season.

The following counties are leading in tonnage of limestone pulverized by home grinding outfits: Rock, Green Lake, Iowa, Green, Dane, and Grant. Several machines have been introduced recently into Grant County and no doubt the tonnage will be increased greatly next season. At a meeting in Buffalo County, 2,385 tons of limestone was subscribed for on condition that some one individual purchase a machine. At a meeting in Monroe County, farmers also subscribed for about 1,000 tons of pulverized limestone. As a result of this meeting one of the men in the audience will purchase a big machine soon. Last summer a cow tester near Middleton called a farmers' meeting and farmers subscribed for 1,000 tons of ground rock. Present figures indicate that there was about 40 per cent more limestone purchased from commercial companies during 1923 than during 1922.



Marl, the New "White Gold"

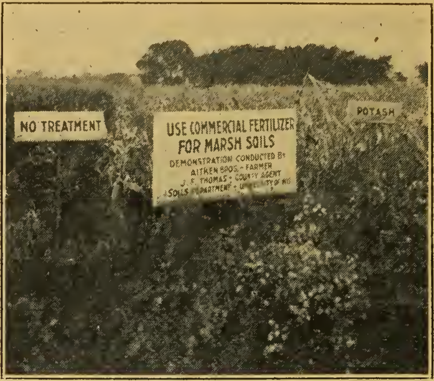
During the past two years large deposits of marl—a new source of agricultural lime—have been discovered in those sections of the state where lime is badly needed. Trials of marl made by farmers in this area on alfalfa and clover fields have clearly demonstrated its worth. Special machinery for the removal of marl from the lake beds where it is most frequently found has been installed at several places and the "white gold" has thus been made easily obtainable by farmers within hauling distance of these deposits.

The general use of marl is certain to produce a profound influence upon the agriculture of these sections. It is the opening wedge to the restoration of dairying and other livestock farming on many farms which had to greatly reduce their herds owing to a lack of forage.

DEVELOP NECESSARY PRODUCING
AND SELLING ORGANIZATIONS

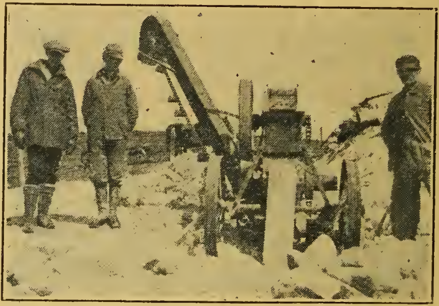
(The fourth signboard)

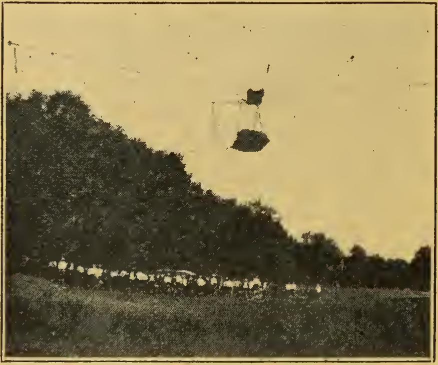
The farmer soon reaches a point in his individual activities when he must have the assistance of his neighbors in order to produce products that will get through to the terminal market.


NO TREATMENT
USE COMMERCIAL FERTILIZER FOR MARSH SOILS
DEMONSTRATION CONDUCTED BY
AITKEN BROS. - FARMER
J. F. THOMAS - COUNTY AGENT
SOILS DEPARTMENT - UNIVERSITY OF WIS
POTASH

Top—A demonstration of the proper use of fertilizer on marsh soils in Waukesha County.

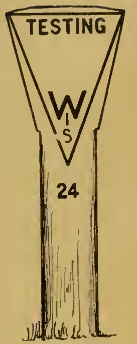
At right—Lime grinder at work in Racine County. "Lime, inoculation, and manure make alfalfa trebly sure."





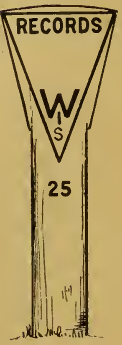
At left—Marl digging machine lifting "white gold" from the bottom of the lake and dumping it on the bank in Portage County.

This is especially true with those products requiring bulk shipments, like potatoes, cattle and dairy products. This economic pressure has brought about the development of cooperative creameries and cheese factories and recently their consolidation into federations for the more efficient handling of dairy products. It has also been the chief factor in the organizing of potato growers, beekeepers, fruit growers, and like organizations whose chief functions have been the production of quality products, sold under trade names so advertised as to attract the attention of the ultimate consumer, and of such outstanding merit as to win and keep his trade. All these things the group can do, but the burden is too heavy to be borne by the individual farmer.



The Good Work of Cow Testing Associations

COW-TESTING associations have now reached a point in their development where 70,000 head of Wisconsin dairy cattle, belonging to 4,090 owners, are under test. The average production of all cows in the associations is nearly 2,000 pounds a year greater, or 6,882 pounds of milk each annually. It thus becomes possible for association members—under the slogan of "Fewer but Better Cows"—to house, feed, and milk 40 per cent less cows and still get the same amount of milk from the remaining ones as before the elimination of the "boarder cows." This more economical production is a decided factor in determining profits on these farms. Without organization, however, the benefits of the association cannot be easily secured. Not only do these men have "fewer and better cows," but also they soon come to use better bulls—96 per cent of all these herds are now headed by bred-for-production bulls, a percentage far higher than the (40 per cent) general average of the state.

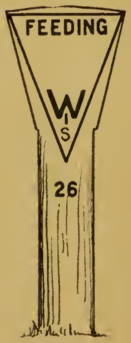


Records Increase Sale Value

Outside buyers demand cows of known production from disease-free herds and are willing to pay a high premium for such animals. Good grade cows with high-production records have sold during the past year for as high as $225 each and the general average price received for cow-test association cows is about $30 per head higher than that of cows of equal quality, but without records. This demand for Wisconsin cows has been built up largely because of educational work done in this state, which in no small degree has stabilized the price of dairy cattle as well as the resulting dairy products.

Better Feeding Results

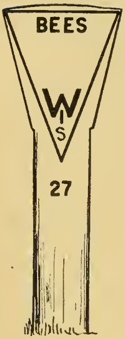
Once the farmer begins to study his records he begins at the same time to improve his feeding practice. This results in the production of milk at less cost through the feeding of better



balanced rations and through savings in the cooperative buying of feeds. Forty-one associations report a saving of $12,600 on the latter item, no inconsiderable sum.

The highest record cow in the associations was a pure-bred Jersey owned by J. C. Mathews, Marion, Wisconsin, with a yearly production of 844 pounds of fat. Next to her stood Kit, a grade Holstein owned by Walter Katterhenry, of Beloit, with 804 pounds of fat to her credit. The highest herd production in the state, shown by association records, belongs to William Jaehing, Fredonia, Wisconsin. His herd of *eleven* Holstein cows averaged 14,243 pounds of milk and 504 pounds of fat each. It should be noted in passing that this high production was made by a small herd—a striking realization of the slogan, "Fewer but Better Cows."

Demonstration Bee Yards



THERE is no section of the United States where beekeeping can be carried on with more certainty of profits than in Wisconsin, but the nature of the problems of this region is such as to require very skillful beekeeping management. Because of the exacting requirements necessary for maximum honey production only a very small percentage of the beekeepers are securing the best possible results.

With the idea of introducing better beekeeping management and at the same time showing the possibilities of the region, demonstration bee yards have been continued during the past year. Ten yards in Rock, Ozaukee, Washington and Fond du Lac Counties were maintained the past summer. Highly satisfactory results have been secured. In every case the demonstration colonies far exceed the others in the production of surplus honey.

The results show clearly the wonderful possibilities for commercial beekeeping in Wisconsin. They also show that the average beekeeper is not giving his bees the care necessary for securing large yields of honey. The results are more striking in view of the fact that the average yearly production for the state is only fifty pounds per colony. The demonstration yards clearly indicate that if every colony of bees was properly managed, the production per colony for the state would be more than doubled.

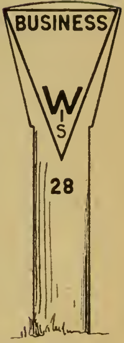
The average honey production per colony for the demonstration yards ranged from 91 pounds, the lowest, to 235 pounds, the highest, while that of the check colonies varied from 36 to 136 pounds.

Decided advance was also made in the standardizing of honey and selling it in a handy package under a trade name. Over 20,000 packages of this quality honey were handled during the year by members of the Wisconsin Beekeepers Association.

Records Should Be Kept

"RUNNING a business without records is like running a clock without hands." Profits in any business are always determined from the balance sheet. Farm profits are no exception to this rule. It is impossible to know costs of production without keeping accounts. No future progress in agriculture is possible either for the individual farmer or for his organization until this fact is firmly established. The time to begin is right now; the place is on the individual farm. Farm organizations cannot hope to succeed with their business enterprises unless the membership takes an active interest in the records and accounts of the organization. Whether they succeed or fail will depend upon profits or prices paid to farmers in comparison with those of their competitors. This necessitates the use and study of records.

That interest in this essential phase of agricultural improvement is constantly increasing is shown by the fact that 3,311 farm record books were distributed by the college for use on farms during the year just closed. This, of course, is in addition to similar records distributed by banks and others for the same use. When we remember that there are not less than 150,000 farms in the state doing business of sufficient size to justify the keeping of accounts it will be seen that there is yet much to be hoped for before the individual farmer comes to know the facts about his own business.

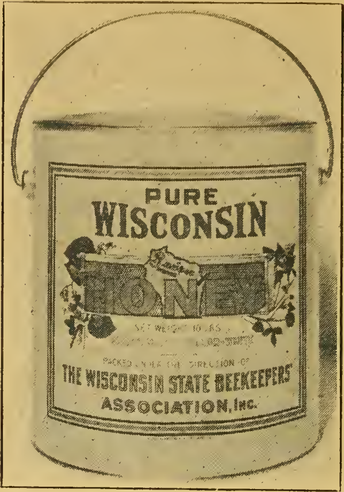


SUPPLY THE PUBLIC WITH
RELIABLE INFORMATION

(The fifth signboard)

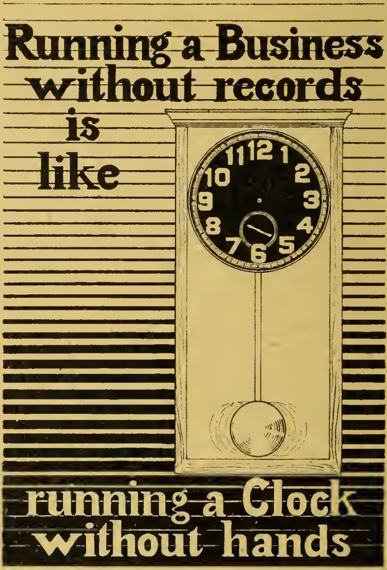
It is an old adage that the hope of a democracy lies in the trained intelligence of its people. War may "make the world safe for democracy," but *education* is the only force that can keep it safe. Education lies at the basis of all progress. It is necessary and vital to the workers in every industry. This is particularly true in the case of the rapidly growing membership of farm organizations. Education is their very life blood. Unless its members are kept informed on the plans and purposes of the organizations, its progress and its problems, its victories and its defeats, its mistakes and its successes, they soon become disinterested, suspicious and dissatisfied, and fall away. *Their only hope for success lies in thorough educational work.*

Similarly the individual farmer cannot get beyond mediocrity without education. Farming in Wisconsin, involving as it does

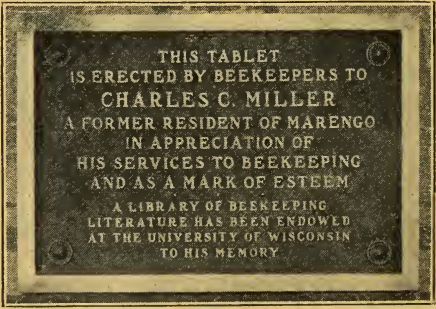


Top—A handy package now used by Wisconsin beekeepers to aid in standardizing and marketing their products.

At right—Yes, you can run a farm, too, WITHOUT RECORDS, but not so well.



USE A WISCONSIN FARM RECORD BOOK
WISCONSIN COLLEGE OF AGRICULTURE



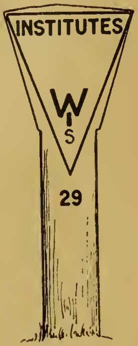
THIS TABLET
IS ERECTED BY BEEKEEPERS TO
CHARLES C. MILLER
A FORMER RESIDENT OF MARENGO
IN APPRECIATION OF
HIS SERVICES TO BEEKEEPING
AND AS A MARK OF ESTEEM

A LIBRARY OF BEEKEEPING
LITERATURE HAS BEEN ENDOWED
AT THE UNIVERSITY OF WISCONSIN
TO HIS MEMORY

At left—Tablet erected to memory of Charles C. Miller at Marengo, Illinois.

an average investment for each and every farm of $25,000, is a business enterprise of no mean proportions. This capital must earn a normal rate of interest and must be able to pay for labor, depreciation, repairs, insurance and taxes if a profit is to be had. Only a trained intelligence can meet this situation.

Again, science, discovery and invention have made valuable contributions to both agriculture and industry during recent years. Some of these things have been of such great importance as to completely revolutionize those enterprises with which they are associated. A single example to illustrate: The automobile has changed the whole scheme of transportation and upset the livestock industry of the country at one and the same time. For the past ten years there has been a gradual decline in the oat production of the United States and of the world. The relation between automobiles and oats is obvious, but the substitution of some other crop for oats is not so easily traced. To say that the popularity of the automobile stimulated the growth of alfalfa is easily within the facts. But alfalfa is a new crop in Wisconsin and its culture must be learned from the beginning. How else than through education?



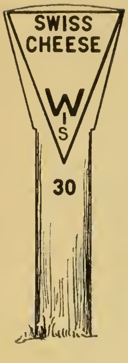
Farmers' Institutes

A NUMBER of institutions have been set up for the purpose of carrying on educational work among farmers on their own land. Prominent among these are farmers' institutes, county agent work, boys' and girls' clubs and work for the betterment of the home and its surroundings.

Farmers' institutes are the oldest form of organized education for Wisconsin farmers and still occupy a conspicuous place. During the past institute season 381 meetings were held, which were attended by over 125,000 men, women, and children, for whom this work is planned.

The subjects discussed included such topics as "The Marketing of Farm Products," "Growing Soybeans," "Liming for Alfalfa and Other Legumes," "Dairy Rations," "Cow Testing," "Successful Cooperation in Wisconsin," "Livestock Improvement," "The Use of Marl," and other related subjects. This effort was not permitted to rest with the mere telling, but was followed up by both institute conductors and county agents. The result was that over 4,000 tons of limestone and marl were actually ordered by farmers attending the institutes, arrangements were made to install lime grinders, or to utilize other existing forms of available lime in nineteen places, and soybean and alfalfa seed was actually ordered from dealers and others for 57 different men immediately following the institutes.

Nor does this cover all of the "follow-up" work. Initial steps were taken at the institutes to organize cow-testing associations, to start a tuberculosis clean-up campaign for the counties, to secure certified seed and pure-bred bulls, and like enterprises. In short, the institutes were made to serve the purpose of mass meetings, which aroused interest along all lines of agricultural improvement, leaving to the county agents the necessary work in actually making such work effective and permanent.

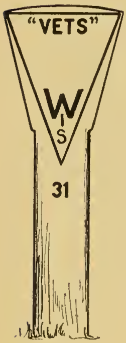


Schools for Special Groups

THERE is a growing demand on the part of certain industries for specific information on problems peculiar to that particular branch of agriculture. This demand has been met by arrangement of a program especially designed for each particular group. The Swiss cheesemakers' school is a good illustration.

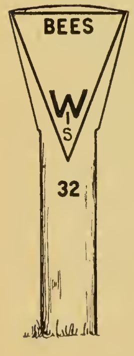
Swiss Cheesemakers' School

Thirty-five cheesemakers from the Swiss cheese area came to this school for instructions in the better care and handling of milk, the manufacture of Swiss cheese from milk delivered once a day, the use of clarifiers, Bulgaricus and "eye-forming" cultures, and other problems peculiar to the industry. As an outgrowth of this special school many of the factories operated by these men have installed clarifiers and are now receiving and using these cultures successfully in their daily work.



Short Course for Veterinary Practitioners

Veterinary practice, like all other scientific work, has made rapid advance during recent years. To enable its members to keep abreast of the times, the Wisconsin Veterinary Medical Association asked that a special school of instruction be arranged for them. This was designed to bring recent discoveries and improved methods in medicine and surgery to the attention of the veterinary practitioners of the state. A new departure for meetings of this association was the substitution of a laboratory and demonstration work for the usual program consisting of formal papers and lectures. The men in attendance themselves actually performed the carefully planned experiments, thus securing first-hand information to use in their regular practice. The course met with the hearty approval of the 150 who attended, and is to be repeated this coming year by request of the various veterinary medical associations of the state.



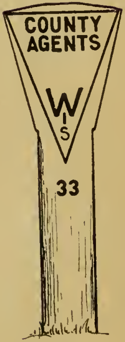
Beekeepers' Chautauqua

The annual convention of the Wisconsin Beekeepers Association was combined with a definite program of instruction by the best talent available. The following taken from one of the leading beekeepers' journals summarizes the work:

"This conference was record breaking in many ways. At no other bee-meet ever held in this country, so far as I know, has there been so large an array of apicultural talent as was presented at this conference. And this was not all. A large tent was provided to hold the assembly. Smaller tents were furnished for the accommodation of beekeepers who came by auto and were willing to enjoy the privileges of camp life."

A special feature of this program was the presentation and endowment of the "Miller Memorial Library" to the University of Wisconsin, the personal library of the late Dr. C. C. Miller, of Marengo, Illinois, said to be the best collection of beekeeping literature in the world.

County Agents an Educational Factor in Wisconsin's Farming



THE work of county agents was completely covered in a recent report entitled, "A Decade of County Agent Work," and will be but briefly mentioned here.

The economic changes which have taken place during the last decade have in like manner caused the farmer to modify his farm practices so as to meet to best advantage these changed conditions. The Wisconsin farmer has become a firm believer in diversified farming, and is going to no extreme on any one crop or commodity, but is constantly increasing his acreage of legumes, such as alfalfa, soybeans and sweet clover.

For example, alfalfa properly can be substituted as a high-protein hay crop, especially adapted to milk making in numerous dairy herds of Wisconsin. The opportunities for county agents to disseminate information about the preparation of the seed bed, the application of lime, so as to correct acidity in soil, the need for inoculation, and other related problems are many.

In his field demonstrations, among other things the county agent has attempted to show that legumes have the ability to accumulate atmospheric nitrogen, increase humus supply, and unlock food stores previously unavailable to the plant. In this he is trying to show that a few years of legume culture on depleted soils will increase soil bacteria, improve mechanical texture of the soil and decrease disease pests and weeds.

The same educational methods applied to the production of other important crops, the breeding and care of livestock, or the production and marketing of farm products are expected to give results in the general improvement of agriculture in its many phases in this state.

217 Projects Carried Out

Fifty-two county agricultural agents, engaged in spreading the gospel of better farming in as many counties during the

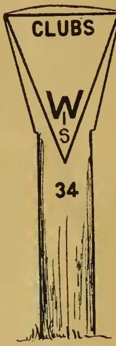
Wis. Veterinary medical Assoc. at the
Short Course for Veterinarians,
University of Wisconsin,
Jan. 24 to 26, 1923.

Above—Wisconsin veterinarians in search of advanced ideas and newer knowledge spend a few days at the Agricultural College.

Center—Calf club boys with their prize Guernseys — a remarkable "action" picture.

Bottom—Boys and calves like these make Wisconsin dairying secure for many years to come.

year, are serving to improve and enrich the lives of the farmer and his family. Two hundred and seventeen definite county projects along various phases of agricultural work have been carried out under the guidance of county agents. Livestock and crop improvement are chiefly state-wide and require the attention of nearly every county agent, while orchard work and land clearing are essentially confined to certain regions. Soil improvement, boys' and girls' club work, and marketing problems are rapidly coming to the front and demanding more and more attention from the county agent as time goes on. Through his project work, the county agent brings to the attention of the farmer the practical application of good farm practices. His methods are to show, to tell, and to convince by demonstration on the farmer's own land.



Training Boys and Girls Through Club Work

THE plans and hopes in club work for the season 1923 were exceeded in many particulars. The enrollment of club members increased more than 20 per cent over last year's enrollment and county agents generally seemed to take a renewed interest and to have a deeper understanding of the real purposes, aims and methods. Emphasis placed upon the importance of the training of youth springs as a contagion from the public at large—a realization that greater effort must be made to conserve human character and effort by a wiser control of the influence of childhood.

Counties and their agents that should come in for special mention because of the outstanding character of club work done are:

Jackson County is emphasizing calf club project on a three-year basis.

Monroe County is using the cow testers as county leaders of calf clubs. Canning was an important project also.

Rock County has an exemplary organization giving emphasis to absolute ownership in calf and pig projects, while the corn work maintained its usual place of prominence.

Oneida County's success with potato project opens the way to calf club work during 1924.

Clark County has used its cow testers as leaders of calf clubs and has had an interested active membership of 168 calf club members that promises much for this plan of leadership.

Washington County is strong in corn and pig projects. It has also held institutes for boys and girls.

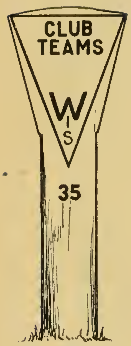
Lincoln and Vernon Counties carried on alfalfa projects along with others. In both these counties special effort was made to add interest to this project. Many adult conversions were made through these alfalfa demonstrations.

Marathon County, with a paid county club leader, had over 700 young folks participating.

Lincoln and Trempealeau Counties had paid county club leaders for summer months, who did exceptionally good work.

Juneau County did good work in the calf and canning projects. This county furnished the agricultural teams that went to Sioux City and Syracuse.

Milwaukee County, under Miss Mary Brady's leadership, had over 250 girls in sewing and canning. This county furnished the girls' demonstration team for the contest at Sioux City.

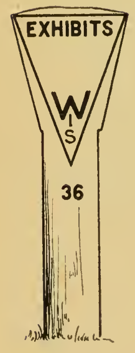


Wood County emphasized the poultry and calf projects with fine results.

In no county were the available social forces of the county used to any unusual degree, though high school teachers furnished fine leadership in many localities. The villages and small cities furnish most of the leadership, but club work will never reach its true proportions in numbers and results unless rural districts furnish their own leadership. The agricultural teacher at Stanley furnishes a plan which is unique and workable. Under his close supervision, he has given his older boys the responsibility of leadership of rural clubs of boys and girls. At Livingston, where the plan has been tried for a few years, comparatively large numbers of young men are manning the rural schools. "There's a reason."

Demonstration Team Work

This phase of club work reached an unprecedented place of importance. Fully 200 teams, consisting of 600 club members, were trained and gave public demonstrations. Out of this number 50 teams were selected to compete at the State Fair. A conservative estimate places the number of public demonstrations given in our state last year at 600. Many of these teams are organized to demonstrate improved methods in the particular form of agriculture needed or practiced in their localities. These teams are used very profitably at farmers' meetings and are pronounced very helpful. The fact that demonstrators are teachers and must know their subject before they can do any effective teaching, makes this activity especially good training for the young folks participating.



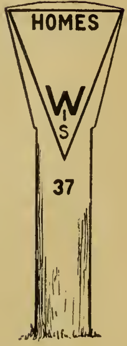
There has been an effort to keep this work practical, not technical; informal, not stilted and lecture-like—in keeping with the ability and likes of the participants.

Club Exhibits

More county fairs made a feature of agricultural exhibits by boys and girls than in years past. Fully 30 county fairs are now featuring this work, while many communities hold local fairs to show the products of the boys' and girls' work. Fully 500 boys and girls participated in contests at the state fair this year. The dairy side of club work was given especial encouragement at the district fairs of the state. Making an exhibit is a part of each club member's program and the greater portion of the membership participate in it. The need of proper supervision of these youthful exhibitors at the fairs is being cared for in supervised camps which furnish this supervision and afford proper facilities for sleeping and for fun.

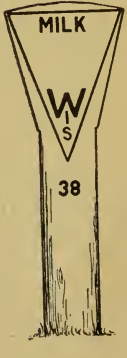
With the rapid changes that have already taken place and are still to take place in the whole scheme of agricultural thought and practice, "leadership" is the one imperative demand. From what source are these leaders to come? Surely not from the cities! Is there a better place to train for this leadership than is afforded by the organization of clubs which combine educational, social and economic features among the young people of the open country?

It is the supreme challenge of the hour!



Happy and Contented Farm Homes the Ultimate Goal

IT IS no idle remark to say that the home is the basis of American civilization. But the American home is found in its most permanent and highly developed state on the prosperous American farm. The degree of its advancement depends in a large measure upon the ability of the farmer to pay for its necessities, its comforts, and its luxuries. Society has forced upon city dwellers certain standards of living which they must attain. No such pressure exists in country life. As a result, standards of living in the city have advanced far beyond the ability of the country to keep pace with them. Improvement of standards of living in the country so that life in it will be equally healthful, pleasant and profitable constitute the chief objective of all efforts for rural improvement. This is the aim of all agricultural extension work, but to this end the workers in home economics have *especially* directed their efforts.



Milk Campaigns

County-wide milk campaigns in Milwaukee, Monroe, Sheboygan and Manitowoc Counties have carried the gospel of "milk, the one protective food in the human diet," to 125,000 people in both city and country. The results of these milk campaigns cannot be easily measured. Increased consumption of milk, improved health of children, better school work, decreased amount of malnutrition are all readily observed.

In Milwaukee County three months after the campaign 16 new schools were taking milk and 7,147 children had begun the use of milk in schools. Daily drinkers of milk had increased 7 per cent. A class of 28 Milwaukee children who were underweight were provided with a pint of milk a day. During the eight weeks in which weekly weights were taken these children increased in weight 20 per cent more than the normal increase for perfectly healthy children. Two surveys taken three months apart show that during this period 2,245 children added milk to their daily diet. Of this number 423 so increased in weight as to be changed from the underweight to the normal group.

In one city milk campaign a firm handling 60 per cent of all the milk supply reported at the end of a year an increase of 26 per cent for the entire year.

But can better health be measured? Can happiness be weighed?

The work of the "milk campaign" is typical of that carried on along other lines as foods, clothing, millinery, home management, household conveniences, rural clubs, for both women and girls. The work has been so arranged that over 12,000 women and girls have received instruction during the year in the art of home making, the only art that will preserve for all time our rural civilization, upon which the perpetuity of American institutions ultimately rests.

When the work of the home can be so simplified that the women on the farms can have time for recreation, for community interests, for self-improvement, there will be the happy contentment on the farm that makes country homes the most desirable in the world.

Attractive Home Surroundings

THE country home, the country school, the country church, and the rural roadside, afford the largest opportunity for outdoor decoration to be found anywhere. Ample space, desirable plants, and easy culture add to the ease and simplicity of the problem. Every advantage should be taken of this opportunity to increase the attractiveness of country life.

During the year, the horticultural department of the college has furnished complete planting plans for fourteen school grounds, nine rural homes, and seven different parks, besides giving help and suggestions for many miles of roadside planting.

This work continued year after year, and, spreading as it will from farm to farm, school to school, and community to community, will soon make Wisconsin one of the most beautiful and consequently one of the most desirable of states for rural residence.

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Subject	Department	In Charge	Field Worker
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eekeeping	Ec. Entomology	H. F. Wilson	L. P. Whitehead
oys' and Girls' Clubs	Ext. Service	T. L. Bewick	Mildred Hagerty Wakelin McNeel
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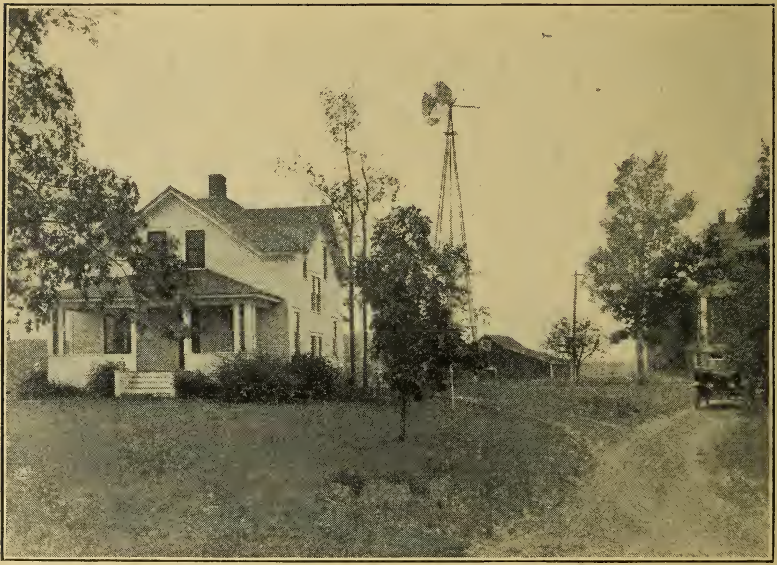

THE END OF THE ROAD

By the side of the road to a profitable market there stands a modest, attractive and comfortable farm house. It shelters a happy, prosperous and contented rural family. Taken together they constitute the ultimate goal of all effort for rural improvement, the foundation of all our prosperity—the very bulwark of American civilization.

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INOCULATE
LEGUME SEED

Extension Service of the College of Agriculture
The University of Wisconsin, Madison

IN SOME PARTS of this country, land left uncultivated will soon produce a fair growth of legumes. This method of securing a stand is not profitable because considerable time is required for the production of a pasture. The planting of legumes without inoculation is similar to this hit-or-miss system of securing a pasture. In fields which are reseeded, the legumes will gradually become inoculated just as the soil gradually develops a crop of wild legumes. If the legume is not inoculated, the nodule bacteria naturally present in the soil in small numbers may come in contact with the roots of the legume and thus there is formed a small amount of what is termed "natural inoculation."

Inoculate Legume Seed

E. B. Fred and A. L. Whiting

IF THE FARMER desires a good even stand of inoculated clover, alfalfa, or other legume he should sow not only the proper seed but also the proper bacteria adapted to this particular crop. This process of sowing legume bacteria along with the seed is called inoculation.

Why Inoculate Legumes?

The purpose in inoculating legumes is to enable the plants to draw nitrogen from the air. There are few soils that are able to supply sufficient nitrogen for uninoculated legumes. The available nitrogen of soils is not a constant supply and the uninoculated legumes suffer when the soil nitrogen is scarce.

Under such conditions the inoculated legumes are not limited because of their ability through the aid of the nodule bacteria to obtain nitrogen from the air. Inoculation of legumes is a form of crop insurance as far as nitrogen is concerned.

The source of the nitrogen for soil building and for crop production is important in agriculture. Nitrogen is the most expensive of the plant food elements if purchased in fertilizers. It is lost from soils in large amounts through leaching. Farm crops and animals remove this element in larger amounts than the other elements of plant food.

In view of these facts it is evident that nitrogen not only should be combined on the farm, but also kept on the farm as much as possible. Inoculated legumes afford the most practical and most economical means of supplying nitrogen for farm use.

The nodule bacteria are the necessary agents that make possible the use of the nitrogen of the air. These bacteria unite the nitrogen of the air with other elements. In combined form the nitrogen is used by the legumes. After it is combined into various compounds, the nitrogen may be used by other crops than legumes depending on whether the legumes are left on the farm.

Nodule bacteria perform a work which is the foundation on which a solution of the source of nitrogen for the farm rests.

Failure to practice inoculation of legumes where it is needed is a form of soil robbery.

The seeding of one kind of legume on a field does not supply inoculation for any other legume, unless they have bacteria in common or cross-inoculate. Alfalfa and sweet clover have the same bacteria in their root nodules or they cross-inoculate.

Sow Inoculated Seed

1. Where the legume to be seeded has never been grown before.
2. Where the legume to be seeded has grown only once.
3. Where the legume to be seeded has not grown recently.
4. Where any doubt exists as to whether the legume to be seeded has been grown on a given field before.
5. Where the soil is sour and the legume to be seeded grew poorly.

When Do Root Nodules Form?

Root nodules are formed when the proper legume bacteria are used and when the plant grows under normal conditions. Every farmer should become familiar with the root nodules of the legume being grown. It is only a small effort to dig up the roots of a few legume plants and examine the nodules. Many farmers have grown legumes for decades and have never examined the roots. This should be done when the plants are from four to eight weeks old. Nodules appear earlier on the more rapidly growing annual legumes than on the slower growing biennial and perennial legumes. They are often not found on the perennial legumes in the late fall. In the following spring a new crop appears on the new roots.

These growths are good evidence of the reliability of the culture used. The presence of many nodules indicates good inoculation. Nodules will not form to the same extent if the plant is suffering from a shortage of some plant food other than nitrogen. Inoculation supplies nitrogen but it does not take care of a lack of plant food of another kind. Nodules vary in shape and size according to the legumes on which they occur and the type of soil in which they are found. The nodules grow in much the same manner as do the leaves and are essential organs for the best growth of the plants.

The location of the nodules on the roots will depend upon the number of nodule bacteria in the soil and on the seed. Where seed inoculation is practiced large numbers of nodules develop on the main or tap root very early in the life of the plant. Later nodules develop on the branching roots.

The nodules of many legumes branch out as they develop. Some form spherical and others fan-shaped growths. In these nodules the legume bacteria perform their work. A single small nodule contains millions of the bacteria. The plant furnishes them with sugar and it receives nitrogen in return. This simple partnership is less wasteful of energy and much less expensive than the chemical processes by which the nitrogen of the air is united with other elements for industrial and agricultural uses.

The nitrogen gained from inoculated legumes is a by-product, which costs practically nothing to produce, because legumes are worth growing for feed, seed, and soil enrichment.

Nodule Bacteria Increase Quality and Yields

Inoculated legumes are richer in nitrogen than the uninoculated ones. Each acre of inoculated legume hay, pasture, or green manure will contain more nitrogen per ton than the uninoculated acre.

Increases in yield with all kinds of legumes are common with inoculation. The extent of the increases in yield that will be obtained from inoculation will depend upon various factors, especially the relation of the other factors of growth to the nitrogen factor. For example, if phosphorus is so lacking that the crop grows poorly, little can be expected of the inoculation. In cases where nitrogen is deficient, nodule bacteria will furnish nitrogen for the plants and such proper feeding increases the resistance of the plant to diseases and to drouth.

While returns from the inoculation of legumes vary, even the small increases in quality and yields sometimes found are important in comparison with the cost of inoculation and should be carefully considered. Small increases over large areas may be just as profitable as large increases on small areas. Inoculation is so easy and cheap that it should be carried out wherever a benefit may be expected.

Culture Method For Inoculation

Properly prepared laboratory cultures possess distinct advantages for applying direct to the seeds. A reliable, concentrated, well developed culture can be grown in such a manner as to exclude the presence of undesirable organisms. Progress in the development of the most efficient legume cultures is based upon careful laboratory preparation.

Cultures when applied directly on the seed enable the young roots to begin drawing nitrogen from the air as soon as the plant can use it. This early nodule formation is important as it gives the plant a start which may influence the rate of growth to the extent that it gives a greater uniformity of maturity. In cases where some natural inoculation occurs or where uneven soil inoculation is applied, the plant roots must grow through the soil until they come in contact with the bacteria. This causes a delay in growth which may be disastrous besides resulting in a serious unevenness in maturity, especially with soybeans and peas.

How to Get Cultures

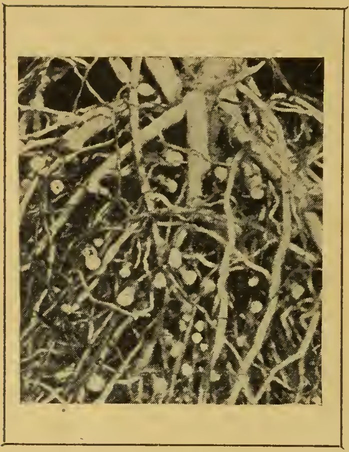
The College of Agriculture will supply cultures within the state at cost. The cultures are grown on a jelly-like substance and distributed in bottles. Each bottle of cultures will inoculate the following amounts of seed of one kind of legume:

20 pounds of alfalfa, sweet clover
20 pounds of red, mammoth, and alsike clover
30 pounds of soybeans, cowpeas, garden beans and vetch
60 pounds of garden peas, field peas

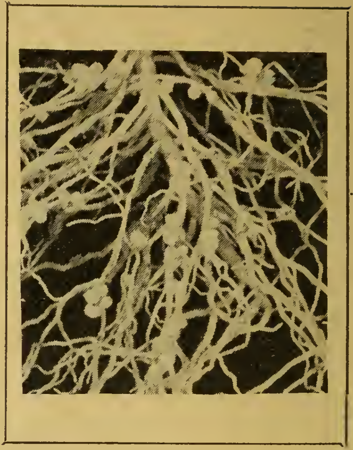
The cultures give the best results when fresh from the laboratory but will keep at least 30 days if stored in a cool, dark place. The cultures are sent directly to the farmers by parcel post and cost 25 cents a bottle postpaid. A money order or check made out to the Department of Agricultural Bacteriology should accompany the order, otherwise the package will be sent C.O.D. In this case there is an additional charge of 10 cents for the C.O.D. fee. In your order state the exact number of bottles of each culture you wish. The order should reach the College at least ONE week before you wish to plant. Orders can be filled on shorter notice, but it is an aid to better service if they are received earlier.

The letter should be addressed to the Department of Agricultural Bacteriology, College of Agriculture, Madison, Wisconsin.

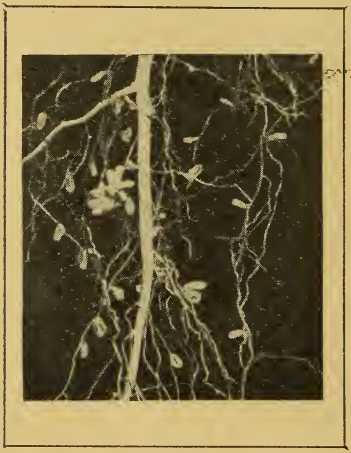
Legume Nodules



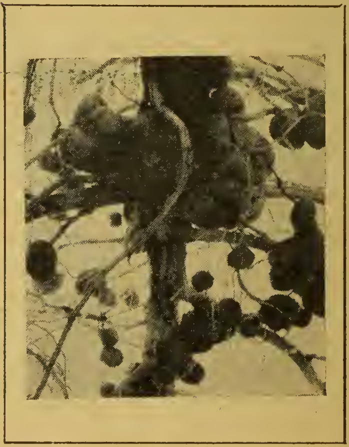
Red Clover



Pea



Alfalfa



Soybean

Published and distributed under the Act of Congress, May 8, 1914, by the Agricultural Extension Service College of Agriculture of the University of Wisconsin, K. L. Hatch, Assistant Director, the United States Department of Agriculture cooperating.

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Circular 169 April, 1924

Abortion in Swine

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APR 4 1924

EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN, MADISON

Department of Veterinary Science,
Wisconsin Agricultural Experiment Station,
Madison, Wis.

Dear Sirs:

Are you in a position to tell me the cause of sows losing their pigs about three weeks prior to proper time to farrow? These sows have had ample exercise and a ration of about equal parts oats and corn.

Is abortion in one class of animals communicable to other classes on the farm? I had a couple of ewes lose their lambs and I wondered if the sows would contract the disease and abort. What is your opinion? What can I do to prevent further trouble along this line?

Thanking you for any information you may give, I remain

Very truly yours,

....

The above letter was received from a representative Grant county swine breeder. It is reproduced here because it asks pointed, practical questions about abortion of swine. As the information requested is of interest to all farmers, this circular has been written as the best means of carrying it to them.

Abortion in Swine

F. B. Hadley and B. A. Beach

ABORTION IN SWINE is a disease resulting in the expulsion of undeveloped pigs. In exceptional cases the fetal pigs die and are retained in the uterus, undergoing either decomposition or mummification. When the pig is born alive but prematurely, it is referred to as premature birth, although the cause may be the same. Observations show that abortion in swine herds usually persists for 3 to 5 years, the greatest percentage of losses occurring the first or second year, after which there is a rather rapid decrease due to the gradual establishment of herd immunity. Gilts are much more likely to abort than are sows. Fortunately, most sows abort but once, which indicates that some protection is derived from having had the disease.

Swine Abortion Spreading in Wisconsin

Inquiries made in 1920 among breeders of purebred swine in Wisconsin revealed the fact that many of them had experienced losses from abortion in their herds. That these abortions were in large part due to infection is now well established. Moreover, it is certain from information recently secured, that the disease is gradually but surely spreading throughout the swine-raising sections of the state and eventually will become a serious menace to the swine industry unless steps are taken to control it.

The Disease Is Contagious

Although abortion due to other causes does occasionally occur in sows, investigation has shown that most cases of swine abortion are infectious in origin and caused by a specific microbe or germ which is similar to, but not identical with, that responsible for contagious abortion in cattle. The abortion germ usually gains entrance to the body by way of the mouth and is carried from the intestines to the womb by the blood stream. Rarely it enters the body through the vagina. In the womb it multiplies rapidly and interferes with the nourishment of the fetal pigs. This germ has been found in aborted fetal pigs, diseased fetal membranes, and in the milk of aborting sows.

Hairless Pigs and Abortion Not the Same

The disease characterized by the sow giving birth to hairless pigs is the result of a deficiency of iodine in the ration. It must not be confused with abortion. As a matter of fact there is no relation between these diseases. Hairless pigs are carried to full term, as a rule, or several days overtime. Some of them are born dead; others are alive at birth, but live only a short time. This may lead the inexperienced stockman to attribute the trouble to abortion infection, unless he keeps in mind the difference between these affections.

How Abortion Starts and Spreads

Sows generally contract infectious abortion from each other rather than from other species of animals such as cows, ewes, or mares. This practically eliminates the possibility of swine becoming infected from drinking the milk of aborting cows, or of catching the disease from other livestock. The infection is usually introduced into a clean herd by purchase of infected swine. Unbred sows and gilts that were experimentally fed material containing abortion germs did not contract the disease; but pregnant sows did. It is likely that some sows become infected by way of the vagina after the uterine seal has formed, but judging from our experimental work, infection by this path after conception has occurred is infrequent. As a rule the boar is only a mechanical carrier of the germs.

Symptoms Shown by Infected Sows

The expulsion of immature pigs is the chief symptom of the abortion disease. However, many infected sows exhibit no warning symptoms of abortion and the caretaker's suspicion will not be aroused until sows thought to be pregnant fail to farrow.

A sow infected with abortion is shown on the cover of this bulletin. From one of her aborted pigs a pure culture of the abortion germ was recovered. She aborted first in 1920, but farrowed normal litters in 1921 and 1922.

Usually the aborting sow shows but little physical disturbance. Exceptionally, inflammation of the womb follows, and when this is severe, blood poisoning occurs and death is the result. Some infected sows farrow normal pigs due to their ability to fight the attacking germs successfully. Such animals are nearly as likely to transmit the disease to pregnant sows in the herd as are sows that actually abort. A certain percentage of aborting sows experience such severe disturbances of the reproductive organs that they become sterile, or non-breeders.

How to Identify the Disease

The most reliable and satisfactory means of detecting abortion infection is the blood test. As this test requires laboratory facilities, the Department of Veterinary Science at the Wisconsin Agricultural Experiment Station has arranged to make it for residents of the state upon request, at the very nominal charge of ten cents for each blood sample.

To secure a sample of blood for testing, the hog is confined in a crate or snubbed to a post; then the tip of the tail is cut off with a sharp instrument and the blood caught in a small vial or bottle fitted with a cork. To stop bleeding, a string is tied tightly about the tail, but it should be removed after 24 hours. When preferable the blood may be secured from one of the large veins in the ear by inserting the hollow, pointed needle of a hypodermic syringe. Packages containing blood samples for testing should be mailed under a special delivery stamp to insure against delays in the mail.

Treating and Preventing Abortion

No medicine or drug has yet been found that will cure or prevent abortion in sows caused by germ infection. However, veterinary care should be given sows that have aborted from such cause, also to those that show a discharge from the vagina. Specific directions for the treatment of such cases should be secured from the local veterinarian, as each case requires somewhat different treatment, depending upon the severity and extent of the disease and the complications that have occurred.

Mineral preparations have no value as a remedy for infectious abortion in livestock. There is no doubt, however, that they should be supplied when there is a lack of minerals in the ration, since they furnish the elements necessary for bone building. The use of iodine in the form of potassium iodide is recommended as a preventative of hairless pigs* but it should be distinctly understood that this infection is in no way connected with abortion.

Vaccination of sows and gilts in infected herds with live culture vaccine about three weeks before breeding is advised as a means of preventing abortion infection. So-called "carriers" of the disease are not likely to be established by the use of the vaccine; neither is the vaccine at all likely to cause permanent injury. A small percentage of sows and gilts fail to conceive after vaccination, but this is as often attributable to other influences as to the vaccine.

Although abortion vaccine has not yet been used very extensively on sows, is has given good results experimentally. Consequently the College recommends its use and agrees to furnish it at cost, five cents per dose, if the owner will agree to keep breeding records on blanks to be furnished and return them as soon as all vaccinated sows have farrowed.

In any event, precautions should be taken to prevent the introduction of the disease-producing germs in clean herds by putting in quarantine for 30 days all swine brought on to the farm. Of course all aborted pigs, afterbirths, and contaminated litter should be removed promptly and disposed of by burning, in order to keep the disease under control. It it also necessary thoroughly to clean and disinfect the pens.

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*Wis. Agr. Exp. Sta. Bul. 350—Minerals for Livestock

Managing an Infected Herd

The following suggestions for the management of a herd of swine in which infectious abortion has broken out are based upon practical experience. By putting them into practice it is believed the disease may be brought under control in the shortest possible time.

1. Remove aborting sows at once from contact with other sows and gilts.
2. Collect and burn aborted pigs, afterbirths, and all contaminated feed and litter.
3. Find out whether the abortions were caused by abortion germs by having blood samples tested to detect evidence of the disease.
4. Consider the herd infected if any of the blood samples are found to react to the test for abortion.
5. Divide the non-reacting sows into as small groups as possible.
6. Disinfect the hog houses by thoroughly saturating the floor, walls, and troughs with a coal-tar disinfectant prepared and applied according to the directions of the manufacturer of the product.
7. Sell for slaughter grade sows which abort as soon as their condition will permit, as such animals will scarcely pay for the trouble of treatment.
8. Postpone breeding sows that have aborted until they have passed at least two heat periods.
9. Keep a special boar for the aborting and infected sows. This of course is impractical except in large herds.
10. Provide a clean boar for all sows that show no evidence of infection.
11. Ask your veterinarian to secure vaccine from the College of Agriculture to vaccinate all open sows and gilts that have not aborted in order to prevent them from contracting the disease.

How to Prevent and Control Animal Diseases

Construct suitable quarters
Select animals carefully for breeding
Identify animals in some way
Immunize animals against disease
Provide an adequate ration
Rotate pastures
Utilize mineral mixtures
Eliminate disease carriers
Isolate infected animals
Institute a quarantine
Dispose of wastes
Disinfect the premises
Cremate or bury carcasses
Protect animals during transportation
Apply tests for disease annually

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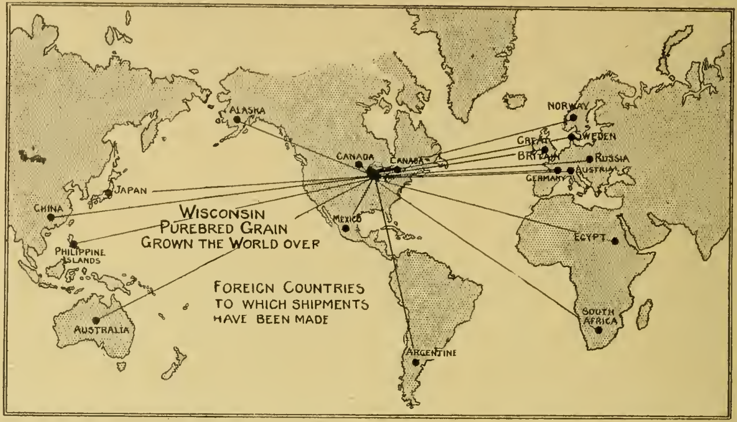
Pedigreed Crops Pay

EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN
MADISON



Wisconsin Varieties Grown in Six Continents

The methods of breeding and their product, the Wisconsin pure bred varieties of field crops, have proved so successful that for many years calls have come from all sections of the United States and many parts of South America, Europe, Asia, Africa, Australia, and the other countries of our own continent for seeds of these varieties. This wide demand made Wisconsin famous as a source of good seed, and has built up a profitable business of seed production for hundreds of progressive farmers.

Pedigreed Crops Pay

R. A. Moore and H. W. Albertz

HIGH YIELDING GRAINS lower the cost of crop production, multiply the acre returns, and increase the profits in farming.

Low producing seed grains at any price are too expensive in time, effort, and money. While this has always been the case, it is even more true today than in the past. Only the best methods will insure the greatest success in crop production. Good seed, properly sown on the right soil helps to insure a bountiful harvest.

Fortunately, Wisconsin occupies an enviable position in the production of high yielding seed grain. For twenty-five years her investigators and grain growers have been developing and disseminating superior strains until today pedigreed varieties of all the common grains are popular in all sections of the state. It has been estimated that 95 per cent of all the barley and 75 per cent of the corn grown within its borders are of purebred varieties.

What the Seed Buyer Wants

High Yielding Varieties—No longer is the careful farmer willing to buy seed grain upon the extravagant claims of a boastful seed catalog. He wants to know the facts about yields produced under actual farm conditions.

Seed that Is True to Name—Appreciating that experimenting is expensive the buyer calls for seed that is "as advertised."

Protection from Weed Infestation—At best it is a hard battle which every farmer has to wage to keep his fields free from noxious weeds. For his protection Wisconsin has built up a system of inspection and certification of seed grain.

Well Cured and Properly Stored Seed—The handling of grain from the time it is harvested until it is turned to the soil as seed is of utmost importance. To meet these needs careful methods of curing and storing seed have been developed.

The Wisconsin system of seed grain improvement, dissemination, and production have attracted wide attention. The performance of the seed, under practical farm conditions, has won for it well merited favor.

Accordingly, the demand for this seed has grown steadily until now shipments into other states and countries, by individual consignment and in the carload lots, annually amount to a tremendous volume.

Because of the important bearing the processes of breeding have upon the production of high yielding grains, the following descriptions are added.

Rigid Selection Made

In the selection method foundation stock from the best known varieties are sown in one-twentieth acre plots and the plants are studied during the growing period. The best heads from 100 plants are selected when mature, the kernels graded, and the heavy plump ones retained. These select kernels are sown the following year and the grains are again graded as before.

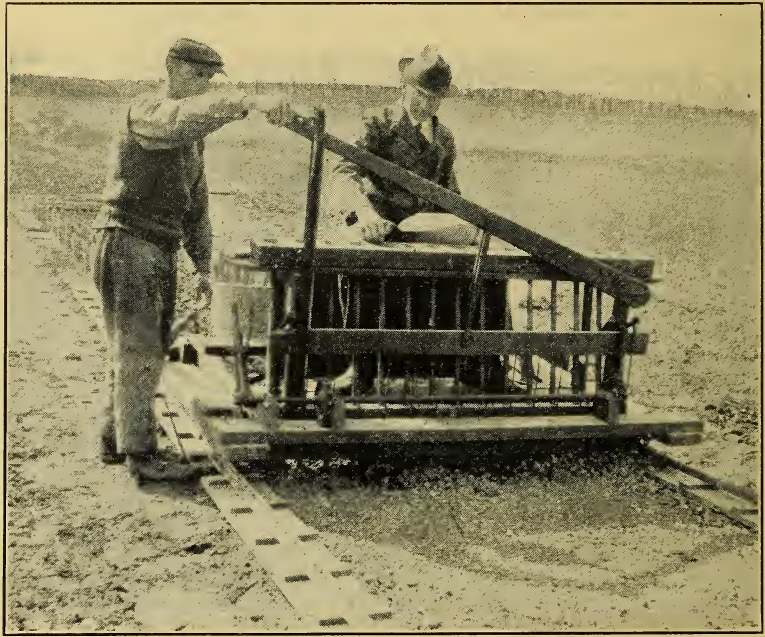


Fig. 1.—Centgener Planter

The Pedigree Process

By the centgener system three thousand kernels of the grain desired for foundation stock are used and the individual kernels are planted four inches apart. Border rows are grown around the outside of the bed which are later discarded. Only the plants growing under uniform conditions inside of the border rows are retained. These plants are studied during the growing period and those showing superior qualities are marked by placing a stake or wire rod beside each one. Twenty plants are usually selected from each bed. The heads are clipped from these plants and put into separate envelopes. The twenty envelopes, each containing the progeny of individual plants, are weighed separately. The ten having the highest weight are retained and the lighter ones discarded.

The second year the seeds in each of the ten selected envelopes are sown an equal distance apart in the little square plots known as centgener beds. A study of the plants is made during the growing period and the best heads from at least ten of the best plants are secured. These heads are placed in envelopes, the shrunken kernels having been discarded, since only the best seeds are to be used the following year.

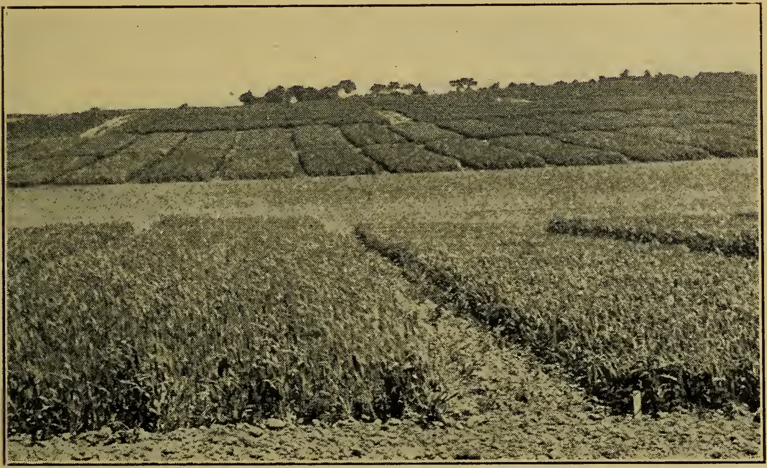


Fig. 2.—Breeding Plots at the Experiment Station

The third year the process of the second year is repeated, and in the fourth year the entire yield of each of the ten centgener plots are compared with that of each of the other nine, and the grain from the four plots in the test giving the greatest yields are retained for increase plots.

In the fourth year sufficient seed is secured from the centgener plots to sow broadcast at least one square rod of each variety, after casting out light seed. These are called increase plots. From the increase plots sufficient seed is produced to sow a tenth of an acre from which the yield of grain is sufficient to sow an acre. An accurate record having been kept of this process for six successive years, the variety becomes a pedigree variety.

Compare Single Plants

The head-to-row method, used extensively by plant improvers, enables the operator to select in the shortest possible time various plants that possess high yielding power and other desirable characteristics. It is a quick method of grain breeding by selection.

Land that is uniform in fertility is used for the selection beds. The grain plants from which the heads are taken are selected from fields or mother beds where several thousand plants are grown under uniform conditions. Plants are not selected from the edge of a field or some favored spot. From ten to a hundred plants especially noticeable for their desirable characteristics are selected from the various grain fields or plots, and the most desirable heads taken from each. These heads are shelled separately, placed in bottles or envelopes, numbered, and held until time for planting. The best progeny of a single seed from the previous year is thus retained.

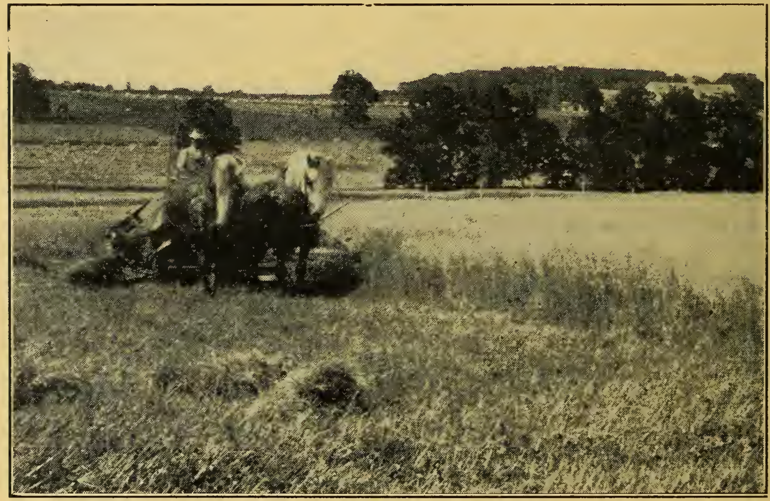


Fig. 3.—Field of Pedigreed Grain

The same number of seeds from each of the different heads are selected for planting each individual row. The seeds are planted the same distance apart in the row and the same space is left between the individual rows.

This system of planting admits of easy comparison of individual plants of the some variety or of different varieties by simply comparing the rows.

The entire plot receives the same care and attention and is finally harvested, each row separately.

The rows are threshed and the yields from the individual rows determined. A few of the high yielding rows of the best quality are retained for increase plots, and the remainder cast out. The following year a comparative test for yield and desirable characteristics is made between the increase plots. Only those plots of grain that come up to the desired standard are retained for a field test.

The object of the breeder is to isolate single individual plants that have in them the power of perpetuating their special characteristics of yield, quality, and vigor far in excess of other plants growing under similar conditions.

Establish New Strains by Crossbreeding

To obtain new strains of wheat, oats or barley by crossing or hybridization it is necessary to remove the stamens of the flower before they are far enough advanced to shed their pollen, and a few days later to introduce pollen from another plant. This requires care and skill, as it is easy to injure the flower sufficiently to destroy its fertilization.

After the stamens are removed and the pollen from some other plant is introduced, the flower again is closed and covered with thin tissue paper to allow light to penetrate but to prevent the pollen of any other plant from entering. Usually all except a small number of the flowers on the spike are removed, for more satisfactory results can be obtained when only a few of the flowers are used.

Fig. 4.—Cold Resistant Golden Glow Corn

How Pedigreed Seeds are Disseminated

As soon as a superior strain has been developed it is disseminated among the members of the Wisconsin Experiment Association, most of whom have completed a course in agriculture at the University. Each member is entitled to one bushel of small grains or enough corn to plant an acre. Each variety is thus increased rapidly and disseminated widely in a short time. If the members desire to sell seed they report the name of the variety, together with the amount offered for sale, to the secretary of the Association.

The seed is carefully inspected both in the field and later in the bin by a representative of the Experiment Association to determine its trueness to type, freedom from mixture with other grains, freedom from weeds and disease. If the seed passes inspection, the grower's name together with the amount of seed he has for sale is listed in a special pamphlet and sent on application to all prospective purchasers of purebred seed.

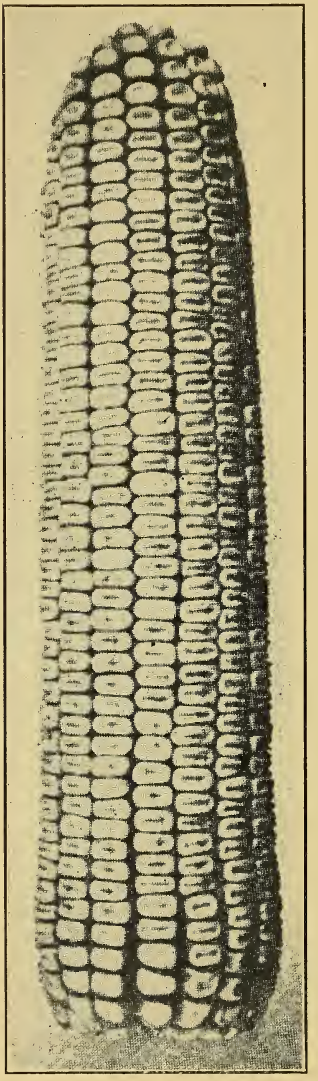


Fig. 5.—Wisconsin No. 12 Corn

FIELD CROPS PRODUCED

As a result of intensive work in breeding, the Experiment Station has produced and disseminated the following varieties of field crops.

Golden Glow, (Wisconsin No. 12) Corn—The ears vary in length from 6 to 9½ inches, with 14 to 18 rows on each cob. The standard length for exhibit and seed samples is from 8¼ to 9¼ inches.. The corn is a uniform soft golden yellow color throughout with a medium cherry red cob. The kernels are not as rough as those of the Silver King variety and have a crumpled indentation.

The Golden Glow variety resulted from a cross between Toole's North Star and Wisconsin No. 8. Both varieties were planted in alternate rows in 1904. The rows planted with Toole's North Star were detasseled and the No. 8 tassels were left to fertilize the North Star rows. The ears secured from these rows were used for further breeding. As soon as type characteristics were established, the seed was disseminated among the members of the Experiment Association.

Golden Glow variety combines the yielding qualities of Toole's North Star with the earliness of Wisconsin No. 8. It is well adapted to the greater part of central Wisconsin, and requires from 100 to 115 days to mature. An early strain of the Golden Glow has been developed which is now grown successfully in several of the northern counties.

Cold Resistant Golden Glow Corn—Owing to the cool weather which frequently prevails during the early part of the growing season and retards the growth of corn a strain was bred which will continue to grow under conditions too cool for ordinary varieties.

This work was begun in 1914 by germinating six kernels from each of a large number of ears, in an ice box kept at a temperature of 42° to 45°F. Those ears, the kernels of which showed any sign of germination were kept for further breeding. After six years of selection, a strain of Golden Glow corn was produced which will grow at a soil temperature several degrees lower than that required for the standard Golden Glow strains. In breeding this strain, every effort was made to maintain the size of the ear and stalk and standard Golden Glow type.

This variety is especially adapted to the northern edge of the Golden Glow region. It produces well on the lighter soils of Northern Wisconsin.

Silver King, (Wisconsin No 7) Corn—This variety is a uniform creamy white corn and has a slight roughness of kernel. The indentation ranges from a crumpled to

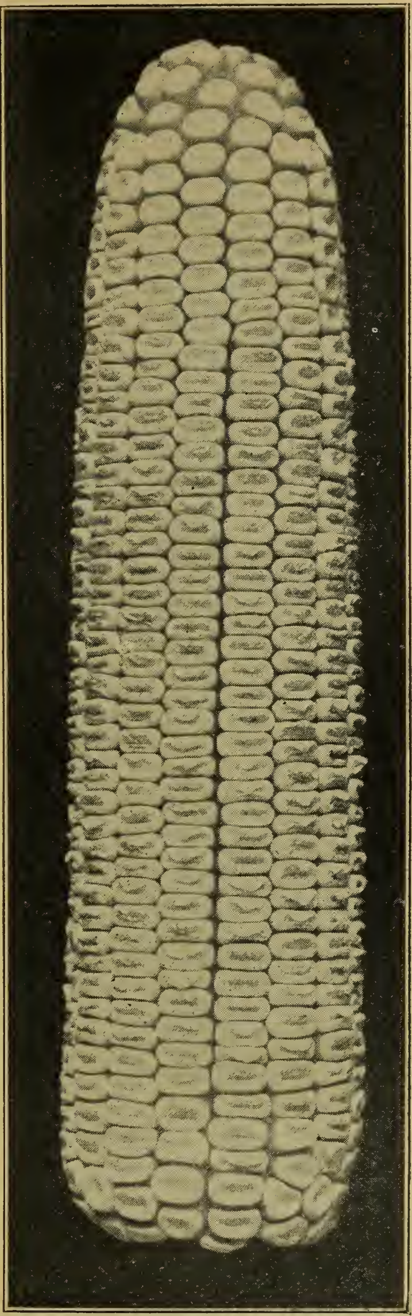


Fig. 6.—Silver King, Wisconsin No. 7 Corn

pinched condition. The kernels are of a medium depth, medium wedge-shaped and somewhat broad. The cob is glistening white. The length of ears varies from 7 to 10 inches. The standard length is from 8½ to 9½ inches.

The foundation stock of Silver King corn was secured from John Banks, Algona, Iowa, by the Wisconsin Experiment Station in 1904. Since that time it has been improved by ear-to-row breeding and adapted to Wisconsin climatic conditions. This variety breeds true to type and is one of the best yielders for crib and silage corn in the southern half of the state. Reports from Experiment Association members show a six year average (1918-1923) yield of 62.1 bushel per acre, an increase of 18.9 bushel above the state average.

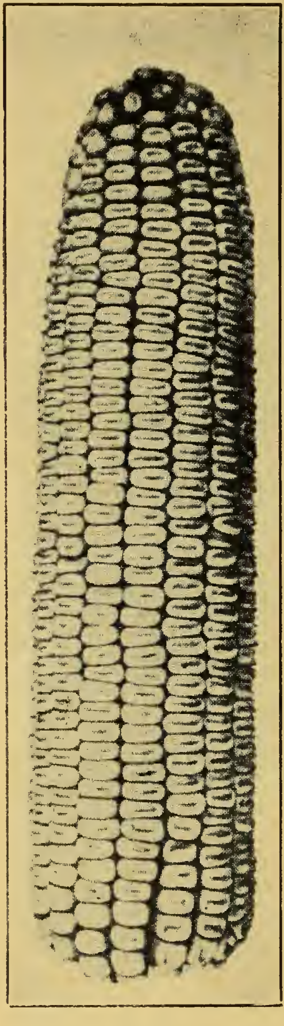


Fig. 7.—Wisconsin No. 8 Corn

Other Varieties of Corn

Early Yellow Dent (Wisconsin No. 8.) This resembles Golden Glow although the ear is smaller, averaging between 6 and 8 inches in length, and is more tapering. The kernels are more lemon yellow in color and the cob is light cherry red. This variety was developed from the Minnesota No. 13 by the ear-to-row method of breeding and is well adapted to northern parts of the state. It requires from 95 to 105 days to mature.

Northern Yellow Dent (Wisconsin No. 25) Corn. This variety was bred at the northern branch station and is well adapted to the northern sections as a seed and silage variety. The color is a rather deep shade of yellow almost orange. The ears are well dented and the kernels are quite deep for an early maturing variety. The number of rows ranges from 12 to 16. Probably 70 per cent of the ears have 12 rows. Wisconsin No. 25 is a cross between Wisconsin No. 8 and an early yellow dent corn from Northern Michigan.

Wisconsin No. 15 is a smut nose flint corn adapted to the northern part of the state. It matures early but does not yield as high as the dent varieties.

Clark's Yellow Dent Corn and Murdock are yellow dent varieties adapted to the southern portion of the state. These varieties were bred at the Experiment Station by the ear-to-row method of breeding. They are noted for their high yields of corn and silage but are too late to be as widely disseminated as Golden Glow or Silver King.

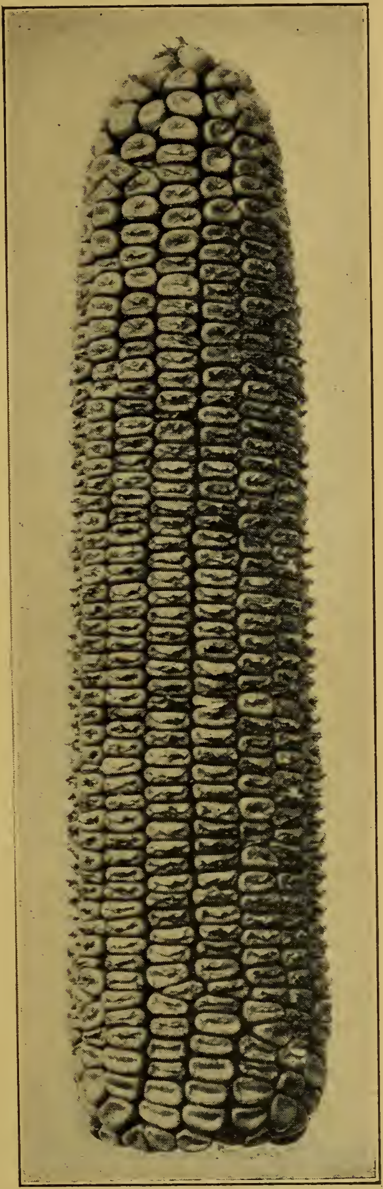


Fig. 8.—Clark's Yellow Dent Wisconsin No. 1 Corn

Pedigree Oderbrucker Barley

The Oderbrucker and Manchuria barley came originally from Manchuria in western China. These barleys were carried into eastern Europe years ago and one strain grown in Oderbruch Germany, was called Oderbrucker.

The Wisconsin Experiment Station took up the work of barley breeding in 1898 and obtained a large number of samples from the United States Department of Agriculture, Canada and Europe. After several years of careful testing of varieties and the breeding of pure lines 16 pedigreed varieties were developed. Of these the pedigree Oderbrucker is of outstanding merit. Reports from Experiment Association members over a six-year period (1918-1923) give an increase in yield for the pedigree barleys of 13.3 bushels per acre over the United States average.

This pedigree barley was also bred for high protein, stiff straw and plump, light colored kernels. It is well adapted to the north central temperate climate where rainfall is not deficient.

WHEAT VARIETIES

Turkey Red Winter Wheat (Pedigree No. 2). This is bearded and has white chaff which firmly holds the dark amber kernels. The plants grow from 3 to 4½ feet tall. The heads are nearly square at the center and somewhat tapering toward the tip.

This wheat was introduced into the United States from Russia in the early 70's. It was tested at the Wisconsin Experiment Station with many other varieties for hardiness and yield and finally used as the foundation stock upon which to breed the Wisconsin Pedigree No. 2 winter wheat. It has now been widely disseminated.

It requires a well-drained and rather heavy loam or clay soil. The counties especially adapted to this crop are those adjoining Lake Michigan, Lake Winnebago, Green Bay and the lower Fox River. The region comprising Polk, St. Croix and Barron counties, as well as most of the counties in the southern part of the state are also particularly adapted to it.

Bacska (Pedigree No. 408) Winter Wheat. This variety was developed at the Branch Experiment Station at Ashland from seed secured in 1908 from the United States Department of Agriculture. The head is relatively long and filled with somewhat boat-shaped amber colored seeds. Some of the special merits of this variety are: Stiffness of straw and heavy yielding capacity. It is particularly adapted to the heavy clay region near Lake Superior.

Marquis Wheat. This variety of spring wheat is awnless and has a smooth chaff and hard chunky kernel with a wide crease. Two or three short awns are usually found at the tip of the heads. In spite of the short chaff or glumes, the seed

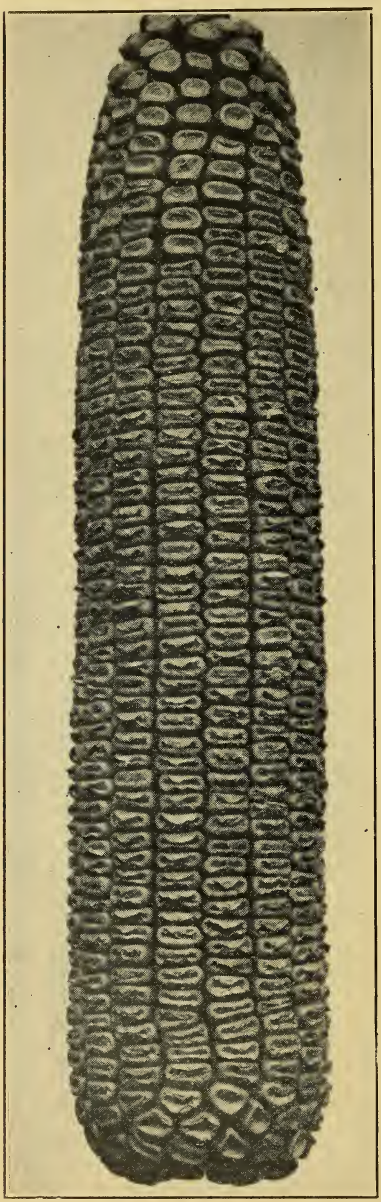


Fig. 9.—Murdock Corn

is held firmly and does not shatter. The milling quality is superior to any other variety in the state.

Marquis wheat is a selection from a hybrid produced by crossing a hard red wheat from India and the well-known Red Fife. This cross was made by the Canadian Experiment Station at Ottawa about 1892 and the Wisconsin Experiment Station received a small amount of this wheat directly from them. It was planted in centgener breeding plots and selections were made for several years. Marquis is now well acclimated to this state and grows vigorously on the clay and loam soils, yielding higher than any other variety. It matures early and escapes the summer droughts, but is very much subject to rust.

WISCONSIN OATS

Wisconsin Wonder (Pedigree No. 1) Oats. This variety of oats grows from 2½ to 5 feet tall. It has a stiff straw and does not lodge as readily as most other varieties. The kernel is large, white and plump. The awn on the large kernel is medium heavy. Wisconsin Wonder is medium early in maturity.

The seed was secured by the Experiment Station in 1901 and improved by the centgener method of breeding. A seven-year test on the agronomy plots proved it to be a superior variety. It became one of the most prominent pedigreed strains which is well adapted to all clay and loam soils. On rich soils it seldom lodges. Reports

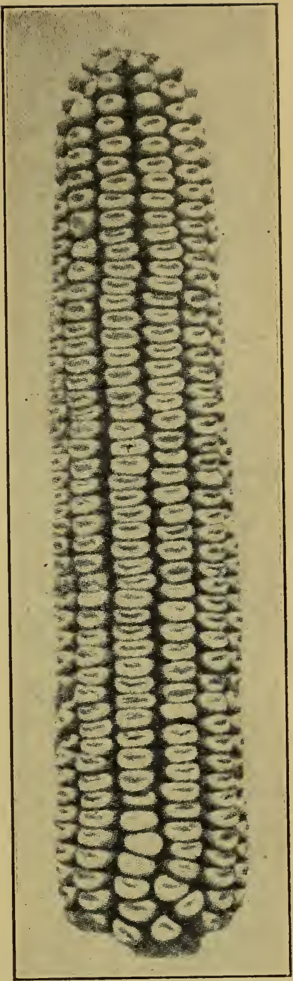


Fig. 10.—Northern Yellow Dent, Wisconsin No. 25 Corn

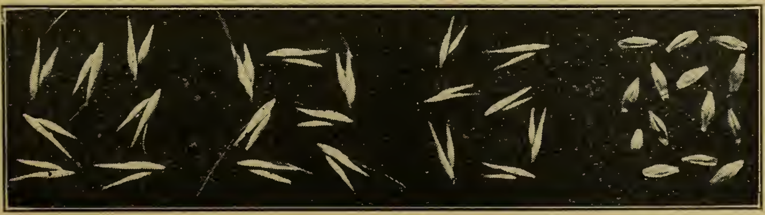


Fig. 11.—Wisconsin Wonder Oats—Swedish Select Oats—Kherson Oats —Oderbrucker Barley

from Experiment Association members for the past three years (1921-1923) show an increased yield of 5.5 bushels per acre of Pedigree 1 oats over the state average.

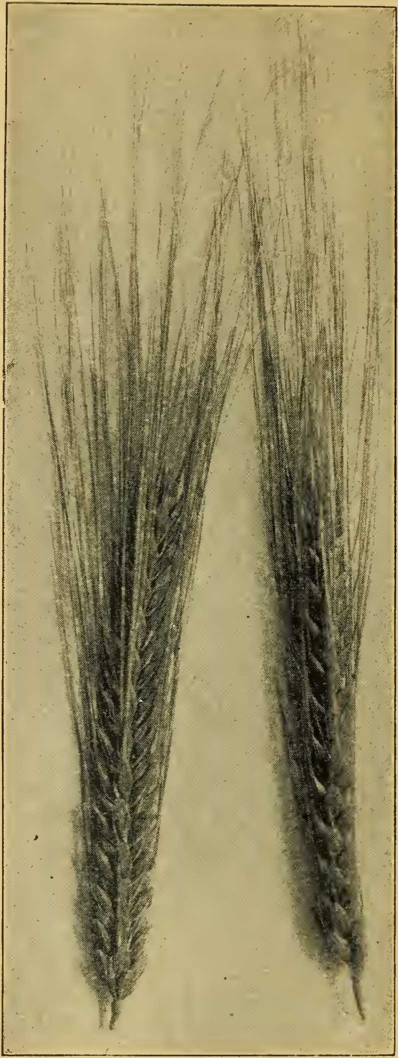


Fig. 12.—Wisconsin Pedigree Barley

Swedish Select (Pedigree No. 5) Oats. The plant has a dense root system, also large leaves and stem. It makes a rank growth which under favorable conditions reaches a height of 5 feet.

This oat originated in Sweden, was imported into Russia and became one of the standard varieties of that country. Dr. M. A. Carleton of the United States Department of Agriculture secured a small quantity of these oats and sent a portion to the Wisconsin Experiment Station in 1898. It was planted in centgener plots and only the best heads from the best plants were planted each year. On the experimental plots it yielded exceptionally well, weighing from 36 to 40 pounds per measured bushel. Under favorable conditions this is one of the highest yielding varieties.

It is well adapted to lighter soils and soils low in fertility It is grown extensively in the sandy region in the central part of the state but on rich clay and prairie soils it has a tendency to lodge.

State's Pride (Pedigree No. 7) Oats. This oats, a pure line selection from the Kherson oats, has come into prominence during the last few years. The original stock of this oats was obtained from the Nebraska Experiment Station in 1906. The Nebraska station obtained its lot from the Kherson district in Russia, where the climate is dry and early hardy varieties of oats are grown.

This oats is yellow, small-kerneled, thin-hulled and early. As a rule the straw is fine and does not grow as tall as the Pedigree No. 1 and matures about a week earlier. Owing to its earliness it is one of the best nurse crops. It often escapes rust, heat and lodging. If it does lodge it fills out the kernel well. For this reason it is recommended for farms having very rich soils. It is one of the highest average yielders. The past three years (1921-23) which were poor for oats, reports from Wisconsin Experiment Association members show an average yield of 53.8 bushels per acre.

The small sized yellow kernel of this oats is somewhat objectionable. On light sandy soils, occasionaly, it does not grow straw long enough to be cut with the binder.

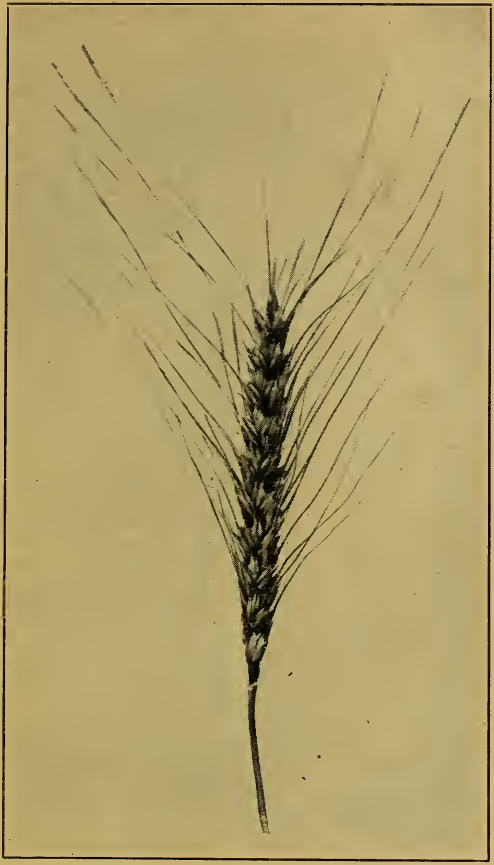


Fig. 13.—Wisconsin Pedigree No. 2 Winter Wheat

White Cross (Pedigree No. 19) Oats. As small size and yellow color were objectionable features of Pedigree No. 7, an attempt has been made to produce a white oat of larger size than the Pedigree No. 7 and still maintain the earliness and high yield. Several crosses have been made with that end in view. The White Cross, Pedigree No. 19, is a pure line selection from a cross made in 1911 between the Big 4 (Pedigree 2) and Sixty Day. The kernel is white, larger than the Pedigree No. 7, the straw is taller, and it is a high yielder.

Forward (Pedigree No. 1241) Oats. This strain was bred at the Ashland Branch Station from Silver Mine stock. In a seven-year test it outyielded its nearest competitor by five bushels per acre. It has a white, plump kernel. The straw is stiff and of medium height. As a yield test is just completed only a small amount has been disseminated.

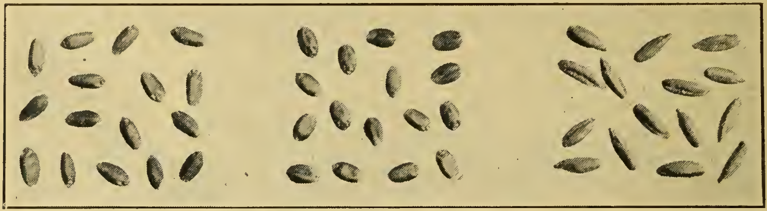


Fig. 14.—Turkey Red Wheat—Marquis Wheat—Pedigree Rye

OTHER VARIETIES DEVELOPED

Pedigree Winter Rye. This is from the Schlansted variety, grows from 5 to 6 feet tall with heads averaging 4 to 6 inches in length. It has a stiff straw and is noted for its high yields, hardiness, and quality of grain.

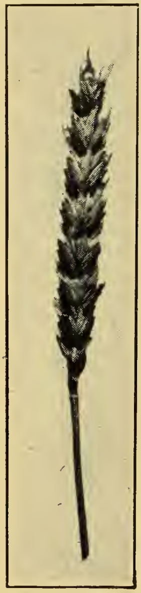


Fig. 15.—Marquis Spring Wheat

A small portion of the seed was received by the Wisconsin Experiment Station in 1900 from the United States Department of Agriculture. It was carefully bred for several years and compares favorably with other varieties. Several re-selections have been made since its introduction.

It is well adapted to the lighter soils and also to soils comparatively low in fertility. Excellent results have been secured on rich sandy soils. This rye responds readily to good soil treatment and will give better returns on the clay loam soils than it will on the light sandy soils.

Rosen Rye. This was introduced in 1909 from Russia by a student at the Michigan Agricultural College. It was later introduced into Wisconsin from Michigan. It is one of the large-kerneled, soft green ryes quite commonly grown in eastern and central Europe. This rye gives a dark colored flour with a characteristic strong rye odor.

Rosen rye is a very good yielder, but severe winters cause considerable winterkilling.

Ito San Soybeans. Ito San is a yellow pedigreed soybean about as large as a navy bean but not as flat. It grows about 3 feet tall.

The breeding work began at the Wisconsin Experiment Station in 1902 and since that time selections have been made to increase yields of both seed and forage.

It is well adapted to southern Wisconsin for seed and silage. In the northern part of the state it can be used only for silage, because the growing season is not long enough for seed to mature.

Manchu Soybeans. The Manchu variety is similar to the Ito San except that the former has a black hilum. The original seed stock was secured from Edward Evans of West Branch, Michigan, in 1918 and since that time special breeding work has been done with it at the Wisconsin Experiment Station.

This variety is adapted to the same climatic and soil conditions as the Ito San. It produces more pods and yields somewhat higher.

Wisconsin Early Black Soybeans. This resembles the Ito San in shape but is somewhat flatter and smaller. The plant grows 2 feet tall and has many pods. The beans are a shiny black color.

The seed was secured by the Wisconsin Experiment-Station in 1902. In row tests with 35 other varieties this one proved to be the earliest and at the same time grew tall and leafy. It was further improved and pedigreed at the northern branch stations.

Early Black matures in the extreme northern part of the state. It is a good hay crop and the beans make rich protein feed for stock. It is not so well adapted as the Ito San to grow with corn for silage in southern Wisconsin.

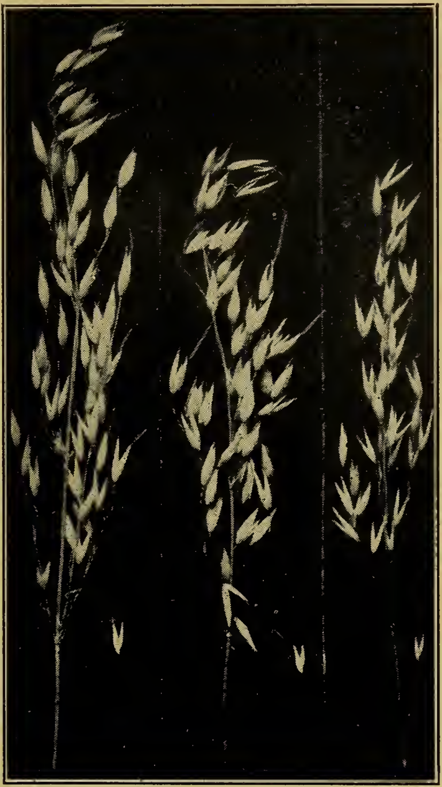


Fig. 16.—Wisconsin Wonder Oats—Swedish Select Oats—Kherson Oats

Mazo Amber Sorghum. Owing to the scarcity of sugar during the summer of 1917, there was a great demand for sorghum. A special effort was made at the Wisconsin Experiment Station to secure sorghum seed which produced plants high in sugar content and free from mixture with other varieties. From a large number of strains tested, the one which gave the best results was secured from S. O. Rabb of Mazomanie, Wisconsin. While this strain was not absolutely pure, several years of breeding resulted in a plant which is tall, uniform, and high in sugar content. The characteristic features of Mazo Amber are that it is awnless, has distinct black shiny glumes, and a long slender panicle. When planted too thin the plants have a tendency to branch and tiller. This variety is well adapted to the southwestern parts of the state. In 1921 enough seed was produced for dissemination among the large number of farmers of the state.

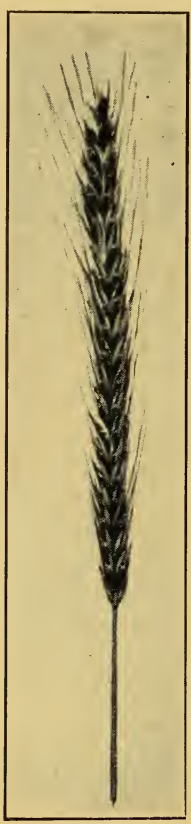


Fig. 17.—Wisconsin Pedigree Rye

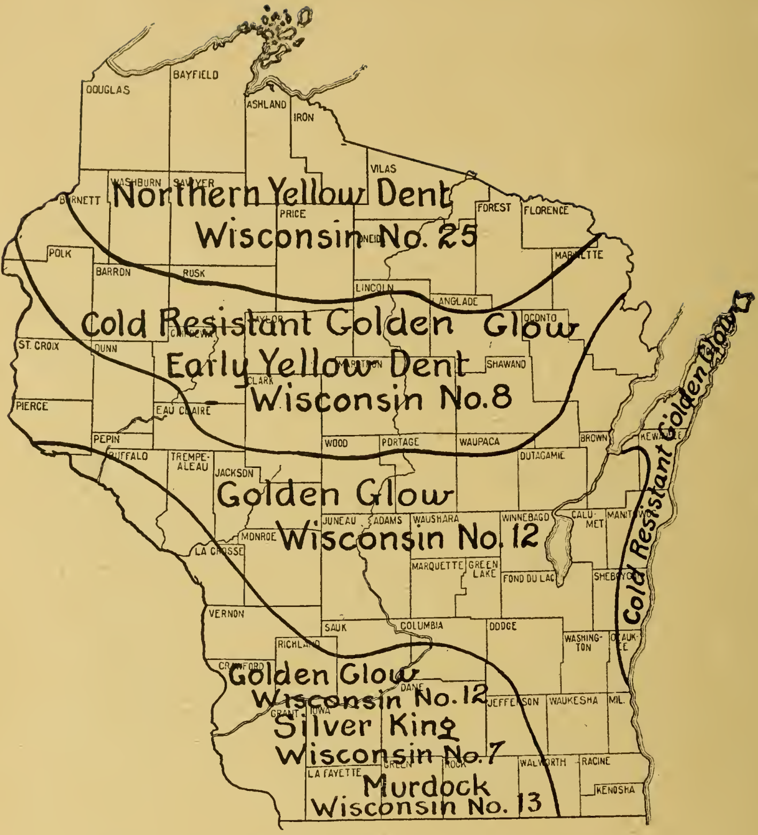
Pedigree Scotch Field Peas. These are one of the most highly prized soup or field variety. They are bright green with a whitish circle and are well adapted to heavy soils. Because the Pedigree Scotch peas require a long season to mature, they should be sown early. As a rule they command the highest market price.

Pedigree Green Field Peas. In general these peas are bluish green although they vary somewhat in color. This variety is of wider adaption than the Scotch, is somewhat earlier in maturity and has greater resistance to heat and drought. Some strains of the Pedigree Green field peas are especially suited to sandy soils. It is an excellent soup variety and usually sells for a little less than Scotch.

Pedigree Marrowfat Field Peas. This is a large white or yellow seeded variety which is a heavier yielder under good cultural conditions than the preceding varieties, but somewhat more exacting in its needs. It is one of the highest priced peas and often exceeds the Scotch and the Green in this respect. Pedigree Marrowfat grows to best advantage on heavy soil; it also requires more seed to the acre than the small sized pea.

All the varieties of pedigree field peas were developed at the Northern Branch Station, where the conditions are typical of the northern and eastern parts of the state which comprise the main dry pea producing area. The comparatively cool summer climate of this region, the prevailing clay soil well supplied with lime, and freedom from insect enemies and plant diseases are the chief factors favoring production.

THOSE who make a business of growing purebred corn to sell for seed, carefully select in the field the best ears from strong healthy stalks for their own seed. This practice keeps the strain at a high level of purity and vigor. In order to prevent the evil effects of too close breeding many growers occasionally exchange seed with another grower of a good strain of the same variety and cross this with their own by planting them together in the same field.



Where Purebred Corn Varieties Are Best Adapted

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Circular 171 W753c ag-tem. May,

Some Farm Weeds

How to Know Them—How to Control Them

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"But when the blade was sprung up, and brought forth fruit, then appeared the tares also."

EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN, MADISON

Keep Weeds Off the Farm

By cutting or pulling all weeds along fences, and in odd spots so their seeds cannot be blown or washed on to the fields.

By using no feed containing unground weed seeds. Bran has been known to contain 108 million weed seeds to the ton. Many weed seeds pass unharmed through animals into the manure.

By piling all manure six feet or more deep. This will kill all weed seeds getting into the manure from feed or bedding.

By careful cleaning of farm machinery when going from a weedy to a clean field, or after hauling dirty grain. Insist on careful cleaning of threshing machine.

By watching for new and troublesome weeds. Kill them before they get established.

By using only clean seed. Sow the seeds of no weeds which will take years of toil and much money to eradicate.

Some Farm Weeds

A. L. Stone

ON MANY farms in this state fully 25 per cent of the crop-producing capacity has been destroyed by weeds. Farmers cannot afford to ignore this weed menace, yet there is a sad lack of concerted action to get rid of these enemies of crop production. Certain parts of the state are so infested with weeds that a determined warfare is necessary to eradicate them.

Noxious weeds are spreading at an alarming rate and it is time the people interested in farming realized the situation. The legislature has named a certain number of weeds which must be kept from seeding. They are quack grass, Canada thistle, burdock, white or oxeye daisy, snapdragon or butter-and-eggs, cocklebur, perennial sow thistle, sour dock, yellow dock, wild mustard, wild parsnip, Russian thistle, wild barley, wild morning-glory and wild onion.

There are laws on our statute books to compel the cutting of these weeds before seed is produced, but to prevent seeding is not sufficient. Steps must be taken to rid the soil of the roots as well as of the seed, if complete freedom is to be obtained.

What a loss of 25 per cent of the crop-producing capacity means to the owner of a 160-acre farm can be shown by a few figures. Twenty-five per cent of 160 acres is 40 acres. At 30 bushels an acre this area should produce 1,200 bushels of barley. With barley at 60 cents a bushel the crop would be worth $720. With land worth $100 an acre, the farm would have a value of $16,000. A loss of $720 on an investment of $16,000 is a loss of 4¾ per cent—more than the average farmer can afford.

Very good crops must be grown on the remainder of the farm if such a loss is to be overcome. Most farmers cannot long make a profit under such conditions. Fortunately such conditions do not exist in all sections of the state, and farmers of the portions which are not yet infested should take extreme care that weeds are eradicatd before they spread.

The successful eradication of weeds depends upon a knowledge of two important points. First, how long does the plant live? Second, how does it reproduce and spread?

Life Periods of Plants

Grouped according to duration of life there are three classes of plants:

An **annual** comes up from a seed, bears flowers and seeds, and dies; all within one year.

A **biennial** grows from a seed but produces only roots and leaves the first year. The root and sometimes the leaves live through the winter.

The second year a flower stalk comes up, seeds are produced, and the plant dies.

A **perennial** is a plant the roots of which live on year after year unless killed in some way. Depending upon conditions, the plant may or may not produce seed every year.

How Weeds Reproduce and Spread

Plants reproduce themselves: First, by seeds alone; second, by roots alone; third, by seeds and roots both.

Practically all annual plants reproduce themselves by seed only. Biennials, also, except for the one winter through which the roots live, reproduce themselves by seeds. Perennials may propagate by means of the roots only, as does the horseradish, which in many places is a bad weed. This plant was introduced into Wisconsin from a warmer country, and though its roots live on for many years, it produces no seed. Canada thistles in many cases spread only by the roots and bear no seeds, while in other instances, where the conditions are favorable, a large amount of seed is produced.

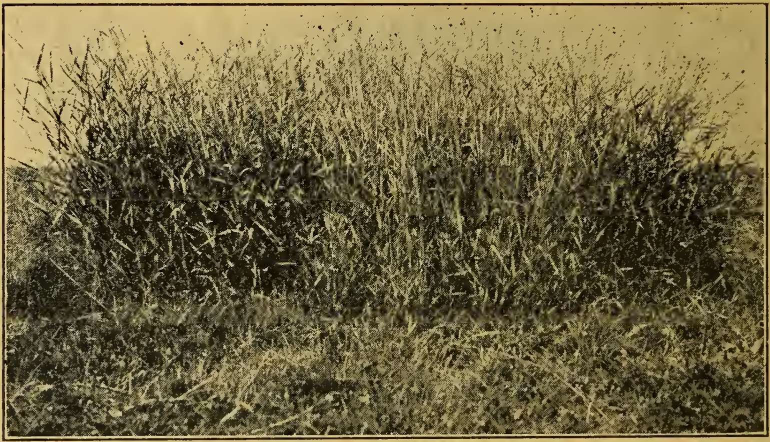

FIG. 1.—A LUSTY PATCH OF QUACK GRASS

This grew from a piece of rootstock two inches long. It was planted in the spring of 1920. The photograph was taken in June 1921. The patch is five feet across.

The wild morning-glory when growing in cultivated ground often produces no seeds but spreads rapidly by its roots. There are other noxious weeds which reproduce and spread both by seed and root, like the ox-eye daisy, the snapdragon or butter-and-eggs, the bouncing bet, perennial sow thistle, quack grass, and several others.

The importance of knowing the habits of any weed lies in applying this knowledge to the eradication of the plant. For instance, it would be useless to summer-fallow a field in order to kill an annual weed like the pigeon grass, which can be kept from spreading by any method that will prevent it from bearing seed. Whether the root is removed from the ground or not is of little consequence if no seeds are allowed to form.

On the other hand it would be equally unwise to attempt to destroy quack grass by preventing it from bearing seed when, in many cases, it really spreads more rapidly by root stocks than by seed. (See Fig. 1.) Hence, to intelligently eradicate any weed one must know its life period and its habit of growth.

How to Get Rid of Annual and Biennial Weeds

For purposes of eradication the annual and biennial weeds may be treated alike. Some of the common weeds in this group are: Sand bur, wild and Indian mustard, Russian thistle, common ragweed, crabgrass, wild buckwheat and corn cockle. Both may be kept from spreading or reproducing themselves by preventing them from bearing seed. The important thing is to decide which is the best way to prevent the plants from bearing seed, and the way chosen will depend upon whether the plants are scattered or whether they are growing closely together in large patches or fields.

Treatment for Scattered Plants

Where annual or biennial plants are scattered there are two ways of killing them, either by pulling them up by the roots or by cutting them. When the plants are pulled up they may safely be dropped where pulled in the field if the seed-pods have not yet been formed. When the seed-pods are once formed, plants usually possess sufficient vitality to ripen the seeds even when they have been pulled up and thrown on the ground. In such case the plants should be carried to some place where they may be burned.

If annuals are to be cut, this should be done, if possible, beneath the surface of the earth. Any other method is apt to leave one or two small branches on each plant, and the entire food-supply furnished by the well-developed root is sent to these branches. They thus grow very rapidly and are practically certain to ripen their seeds unless cut a second time, and even then the seed-pods will probably have formed and will necessitate burning of the plants. A good tool for cutting scattered plants is the "spud" shown in Figure 2.

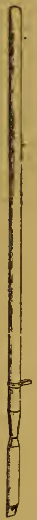

FIG. 2.—THE SPUD

Methods for Large Patches or Fields

Where annuals or biennials are growing in large patches or thickly infest whole fields, other methods than pulling and cutting must be used.

Cultivation

Careful and thorough preparation of the seedbed for every crop is a great factor in the control of annual weeds. Fields which have been fall-plowed usually have a hard crust over them in the spring. The weed plantlets growing in the soil are not noticeable until cultivation breaks the crust and the white or pink stems of the young weed-plants are thrown up sometimes by the thousand. Exposed to the sun and wind, they are practically all killed.

This same cultivation turns a new lot of seeds up to the surface to sprout and within two or three days a new crop of weeds is growing. Another cultivation kills this crop. It would not require many such operations to practically free the crop-producing portion of the soil from weeds. The disk-harrow is an especially valuable tool for fitting fall-plowed land for a crop and killing the young weeds. Even after the crop is planted the field should be harrowed whenever possible to kill whatever young weeds may have appeared.

The value of such cultivation was shown in one instance where seven acres of a certain field were not harrowed. The weather later prevented further cultivation. On portions of the field which had not been harrowed a 200-bushel crop of potatoes was choked out and no attempt was made to harvest a crop. Many farmers hesitate to drag corn, potatoes, or sugar beets early in the growing season for fear of tearing out or covering up some of the young plants. If the dragging is done during the middle of the day or when the plants of corn or other crops are wilted, but little damage will be done. More weeds will be killed by one dragging while they are young and tender than by several cultivations when the plants have become larger and harder to kill.

Besides killing the weeds, cultivation ventilates and warms the soil, supplying much better conditions for germination of the seed and giving the crop a strong, vigorous start. It also encourages chemical action and provides the nitrifying and other bacteria with better conditions in which to work and to render available a larger amount of plant food. Every good farmer has discovered this and always insists on a careful preparation of his land for crops and plenty of the right kind of cultivation afterward. In fact, many farmers even insist that quack grass and Canada thistles are blessings in disguise, because their presence necessitates more intensive preparation of the seed bed and better and more frequent cultivation of the crop than is often otherwise given. The importance of careful cultivation both for weed eradication and its effect upon the soil and the crop cannot be over emphasized. Its value in a measure offsets the expense incurred in eradication. Where crops like corn and sugar beets are drilled in, killing the weeds in the rows while they are small is especially important. If allowed to grow

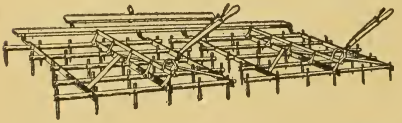

FIG. 3.—THE SPIKE TOOTH "DRAG" OR SMOOTHING HARROW

An excellent tool for dragging out and killing young weeds in corn fields and elsewhere.

to any height it is necessary to cover the weeds with dirt in an endeavor to kill them. This requires deep cultivation and may cut off many of the roots of the corn, retarding its growth and lessening the yield. To offset this damage, it would be well to plant a little additional seed in the beginning.

Rotation of crops. Perhaps one of the best means of successfully combating weeds is by rotating the crops grown upon the infested fields.

A good rotation, especially for the dairy farmer, is one requiring four years and it may include the following crops:

First year—corn with clean cultivation;
Second year—grain crop with clover (10 pounds), timothy (8 pounds);
Third year—two crops of clover-hay;
Fourth year—timothy meadow, or pasture.

For the second year of the rotation barley, oats, or spring wheat may be grown, as best suits the farmer's convenience. In the fourth year a crop of timothy hay may be cut or the field pastured, whichever plan best meets the needs on each particular farm. The sod should be manured and plowed in the fall and the field made ready for corn the succeeding spring. The success obtained with this or any other rotation largely depends upon persistent cultivation.

Shorter Rotations Not Always Good

Shorter rotations are not usually very satisfactory for weed-control, although in some cases and on some soils they serve the purpose admirably. Longer rotations, particularly those including alfalfa, would be even more satisfactory for the eradication of weeds. The establishment of a good crop rotation on a field is usually a guarantee that annual or biennial weeds will be largely destroyed and that even the perennial weeds will be partially controlled.

A few weeds can produce an enormous quantity of seed. At this station actual counts have shown that a well developed plant of pigeon grass will produce 142,000, redroot or rough pigweed 330,000, barnyard grass, 1,290,000, and the tumble weed 6,000,000 seeds. These are among the common weeds infesting cornfields and none of them should be allowed to go to seed.

In this rotation, if the corn is kept clean and cut close to the ground, the field can be left unplowed and the ground for the oats and grass seed be prepared by disking and harrowing thoroughly the next spring. The thorough and careful cultivation of the corn should have killed all the seeds and weeds in the crop-bearing surface of the soil so that the grain crop following should be practically free from weeds. If the ground were plowed a new crop of weed-seeds would be turned up, to grow in the grain unless killed by thorough cultivation before the grain is sown. If properly carried out, this rotation will prevent the production of weed-seeds on the field for four years, as practically no weeds grow in the hay if a good stand is secured.

Are four years of persistent work enough to kill all weeds? They would be, were it not for the great length of time during which weed-seeds may lie dormant in the soil only to grow and reproduce their kind when turned to the surface. Instances are known of weed-seeds growing after having been buried for ten, and even more than forty years! Hence the need of continued rotation.

Chemical spray checks. Another effective method with some weeds, notably the wild mustard, is to apply some sort of chemical spray. Various chemicals have been used with varying success. Iron sulphate and common salt have given good results and are comparatively cheap.

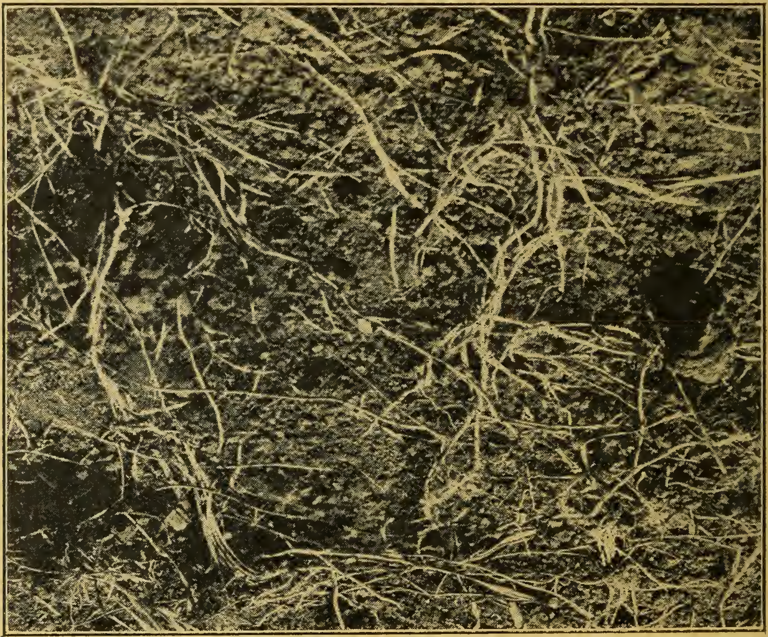

FIG. 4.—QUACK GRASS ROOTS THROWN TO THE SURFACE

When roots are thrown to the surface by a plow and harrow they are readily killed by the sun and wind.

The former can be bought for $1 a 100 pounds, salt at half that price.

A 20 per cent solution of the iron sulphate or a 35 per cent solution of the salt is effective, and easily made by placing 100 pounds of the former or 125 pounds of the latter in a vinegar or kerosene barrel, filling with water and stirring until completely dissolved. It should be applied on a fair day after the dew is off, at the rate of one barrel to an acre. If rains fall within 24 hours a second application may be needed. A sprayer throwing a fine mist that will settle gently upon the plant should be used.

Success depends upon reaching all portions of the plant with the spray. The one ordinarily used for potatoes throws too coarse a spray. The proper implement should develop a pressure of 100 pounds to the square inch. By using a sprayer wth a 20-foot boom, a man with a good team can spray 20 acres a day, provided he has a helper make the solution for him.

This method is advisable only where mustard is very thick. It will kill only the plants which are in the grain at the time of spraying and will have no effect whatever on the millions of seeds buried in the soil. Its effect, therefore, extends only to the year's crop. The spraying must be continued for several years or until the mustard plants are not thick enough to make spraying profitable, when the remainder of the work must be done by hand.

Probably a much greater destruction of wild mustard would result from plowing and cultivating. Successive crops of seeds are turned to the surface, and as rapidly as the young plants appear, they will be killed by cultivation. By continued repetition of this process, the crop-bearing surface of the soil can probably be freed from mustard in a single season.

ERADICATING PERENNIAL WEEDS

Methods of Eradication

Many methods have been devised and advocated for the eradication of perennials. Success depends largely upon soil and weather conditions; and a method which has proven entirely successful under one set of conditions has frequently failed when used under somewhat different circumstances.

Some methods may be used effectively and economically on small patches, but are too costly for large areas.

Methods for Large Areas

Fallowing or cultivation without a crop. This method is successful except on sandy soils which leach badly, soils that are continuously wet, or soils so porous that the horizontal roots are too deep to be reached with the plow. No crop can be grown while this treatment is being given. Then the field should be plowed as soon as possible after the crop has been removed, but should not be plowed while so dry that the soil turns up in large lumps, making it difficult to work. The depth of the plowing is very important as the success of the method practically depends upon it.

First ascertain the depth at which the horizontal roots or rootstocks are growing, and regulate the depth of the plowing so as to turn them to the surface (Figures 4 and 5). In meadows or pastures or any other place where the plants are not cultivated or otherwise distributed the rootstocks of quack grass will be found usually within two or three inches of the surface. In cultivated ground they grow deeper, in some cases below the usual plow line.

After plowing, the field should be cultivated often enough to prevent all leaf growth, for every time the leaves get above the surface they supply the root with food and thus prolong its life. Hence the cultivation must be done before the leaves appear above the ground. The plant breathes through its leaves and if its breathing apparatus is destroyed, it dies for lack of air. The succeeding spring the ground should be plowed again just deep enough to turn to the surface any roots which the cultivator may have failed to reach the preceding autumn.

The object of the cultivation is to drag all the roots to the surface where the wind and sunshine will dry them out and kill them. In a damp season the roots should be removed from the field by use of a horse rake and a big fork (Figure 6). A spring-tooth harrow (Figure 7) or some other good digging tool is preferable to a disk-harrow. The latter cuts up the roots into small pieces and it requires more work to get them all to the surface where they will be killed. Besides, a single portion of a quack grass rootstock bearing a joint will start a new plant even though it is only one-half inch long. It has been shown that a piece of Canada thistle root a quarter of an inch long will often produce a new plant, so it is unwise to cut them up with a disk harrow. The field should be plowed at varying depths at least three times more during the season to make sure that all roots are brought to the surface and killed. The cultivator should be kept going during the time between plowings to prevent all leaf growth.

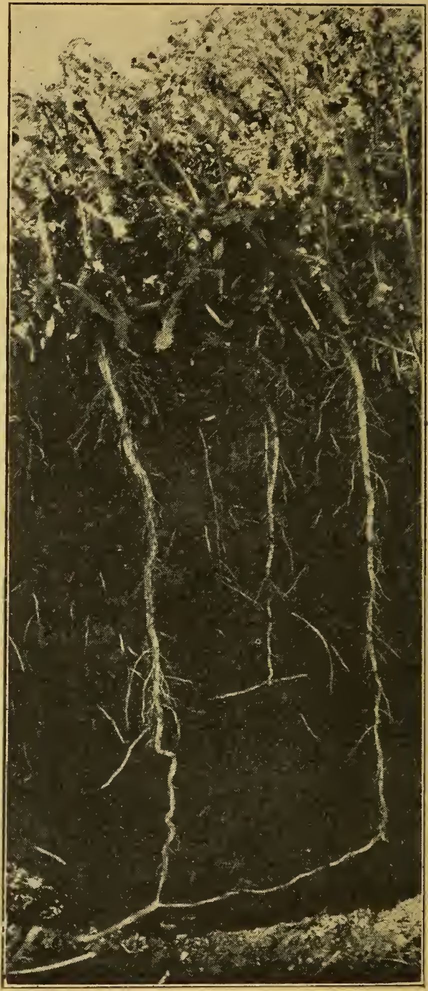

FIG. 5.—RUNNING ROOTS MAKE CANADA THISTLES HARD TO KILL
The plow must get under these roots and bring them up where the spring tooth harrow can reach them.

In case there is any doubt about the complete eradication of the weeds, corn planted in checkrows to allow of cultivation both ways should follow the summer-fallow. Close watch should be kept of the field and if any weeds appear they can be removed by hoeing. It is not probable that any weeds will survive the preceding treatment but it is well to be certain.

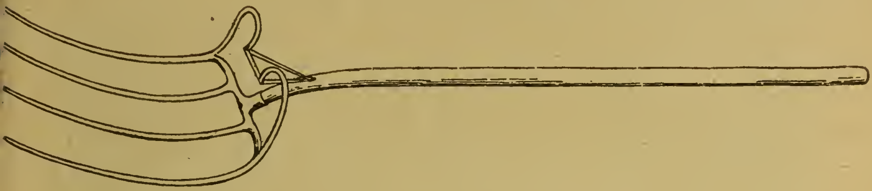

FIG. 6.—THE BARLEY FORK

An excellent tool to pick up dead roots of weeds which have been killed by cultivation.

This fallowing method is more certain to result in complete eradication than any other which has been tried. It gets rid of the weeds with one year's work. The thorough cultivation of the soil puts it into splendid condition, a much larger crop will be obtained the following year than would have been possible had the weeds remained, and the field will continue to bear good crops after the weeds have been eliminated. The dead rootstocks of the quack grass will be converted into humus and so increase the water-holding capacity of the soil. For these reasons it is as economical a method as one which allows the production of crops but extends treatment through several years.

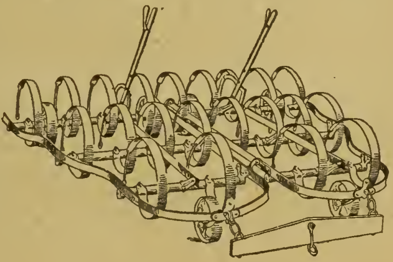

FIG 7.—THE SPRING TOOTH HARROW

One of the very best tools to drag the roots of Canada thistles and other noxious weeds to the surface of the soil where sun and wind can kill them.

Variations of the Fallow Method

Cultivating with a crop. Where perennials which spread by running roots or root-stocks are to be removed while a crop is being raised, plowing should begin the preceding summer or autumn, the earlier the better. This should be followed by careful cultivation until the ground freezes. The next spring plowing should begin as soon as soil conditions permit and be repeated at intervals of four weeks until July. Between plowings thorough cultivation should be practiced. In July the seed-bed should be carefully prepared and the land sown to millet or buckwheat at the rate of four pecks an acre. The previous treatment will have so weakened the weeds that the millet or buckwheat will be well established before the weeds recover sufficiently to begin growth.

Methods for Small Areas

Covering with paper. Perennial weeds in patches not over two rods square can sometimes be economically killed by cutting the weeds close to the ground just when in bloom and covering with tar or some other heavy building paper. The strips of paper must overlap sufficiently to prevent the plants from coming up between the strips and should also extend far enough beyond the edges of the patch so that no plants can reach the air and sunlight.

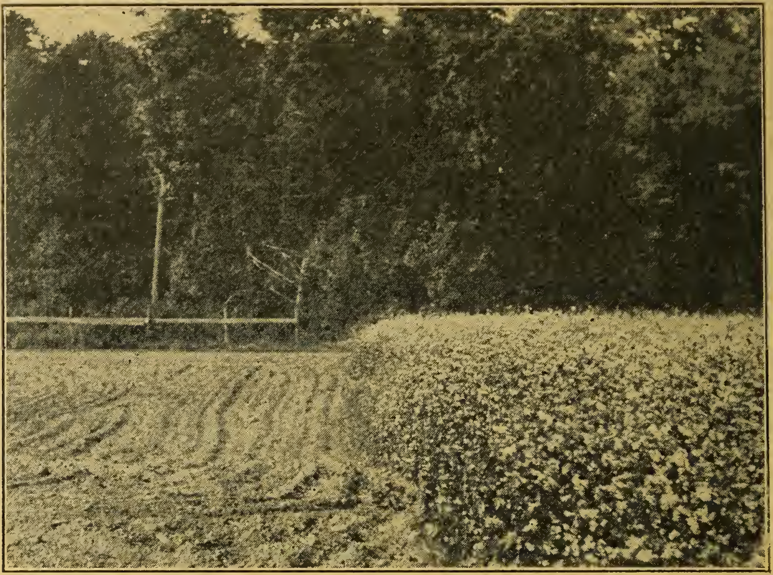

FIG. 8.--BUCKWHEAT IS A GOOD SMOTHER CROP

The worst infested portion of this field is being summer fallowed. Buckwheat can be sown late following early cultivation and complete the process of eradication.

The paper should be weighted down with earth or stone to hold it in place. If the surface is nearly level it would be better to use planks or fence rails to hold the paper in place because the earth is apt to retain moisture and cause the paper to rot.

This method can only be used successfully on fairly level ground where the paper can be held close to the surface. In a dry season 60 days is usually sufficient to destroy the weeds, but it is best to leave the paper on until time to plow in the fall. Should any plants survive this treatment they will be so weakened as to be easily killed the succeeding season.

Close cultivation. Where it is not possible to use the foregoing method either because of unevenness of ground or for any other reason, close cultivation may be practiced. The patch should receive the same thorough cultivation as recommended for large areas, except that much of the work may be done with a hoe.

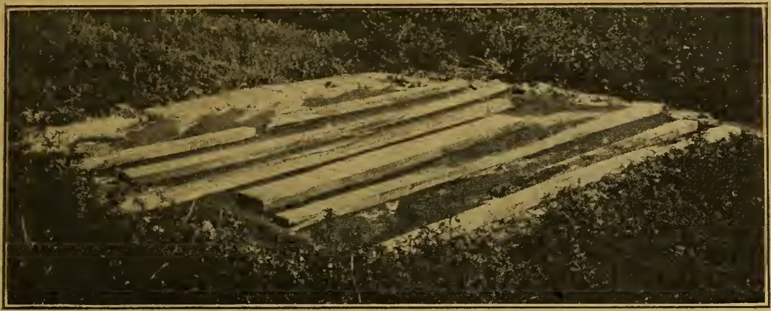

FIG. 9.—WEED PATCH COVERED WITH HEAVY TAR PAPER

Heavy tar paper held in place by planks is the best method for small areas but in larger fields smother crops are more effective.

Special Methods for Canada Thistle

Growing alfalfa. Canada thistles have been completely eradicated where good stands of alfalfa were secured and maintained for three years or more. To secure this result the ground should be heavily manured and plowed as early as possible in the summer or fall and cultivated until early June, when the seedbed should be carefully prepared and alfalfa seed sown at the rate of 20 pounds an acre.

The preceding treatment will have weakened the weeds. The manure will give the alfalfa a good start and provide a rapid growth so that the alfalfa will soon shade the ground sufficiently to prevent the thistles from growing. This method has been successfully used by many members of the Wisconsin Experiment Association.

The sod method. The same results as above noted sometimes can be secured by manuring heavily and seeding down thickly to perennial grasses, such as Kentucky blue grass, red top, and English rye grass, but the stand must be almost perfect and the land allowed to remain in grass for a series of years.

Salting the plant. Cut off the Canada thistle or other perennials with tap or other deep growing roots, while in bloom, just beneath the surface of the earth and apply a large handful of salt, or better yet, a half pint of stiff salt brine where the weed is cut off.

Occasionally this treatment needs to be repeated, but usually one application is sufficient. This method is especially effective when stock is pastured on the field, for in their efforts to get the salt they help to destroy the weeds.

Gasoline for thistles. Gasoline may be substituted for salt and applied in the same way. Carbolic acid also may be used, but must be handled with care. Neither of these is practicable, except for scattered plants or with very small patches, as the material is too costly. They also may be used to advantage on yellow dock, chicory, dandelion, and other weeds with deep growing tap roots.

Costly Machinery Not Needed

It is unnecessary to buy high priced machinery in order to kill quack grass or any other weed. It can be done with the tools which are used on every well-equipped farm. The tools are less important than the will power and persistence of the user. Those illustrated in this circular are sufficient for every purpose if they are properly used. The fact that the most noxious weeds can be eradicated should be emphasized and active efforts put forth to prevent these pests from taking possession of Wisconsin farms. Only by continuing the fight to the end with method and thoroughness can ultimate freedom from noxious weeds be attained.

Clean Seed a Help

The majority of the troublesome weeds have been brought to the farms in crop seeds of various kinds. Obviously it is impossible to keep fields free from weeds so long as farmers persist in using low priced seed which is low priced because it either contains weed seeds or does not grow properly, usually the former. Every weed eradication campaign must be accompanied by one for the use of pure crop seeds.

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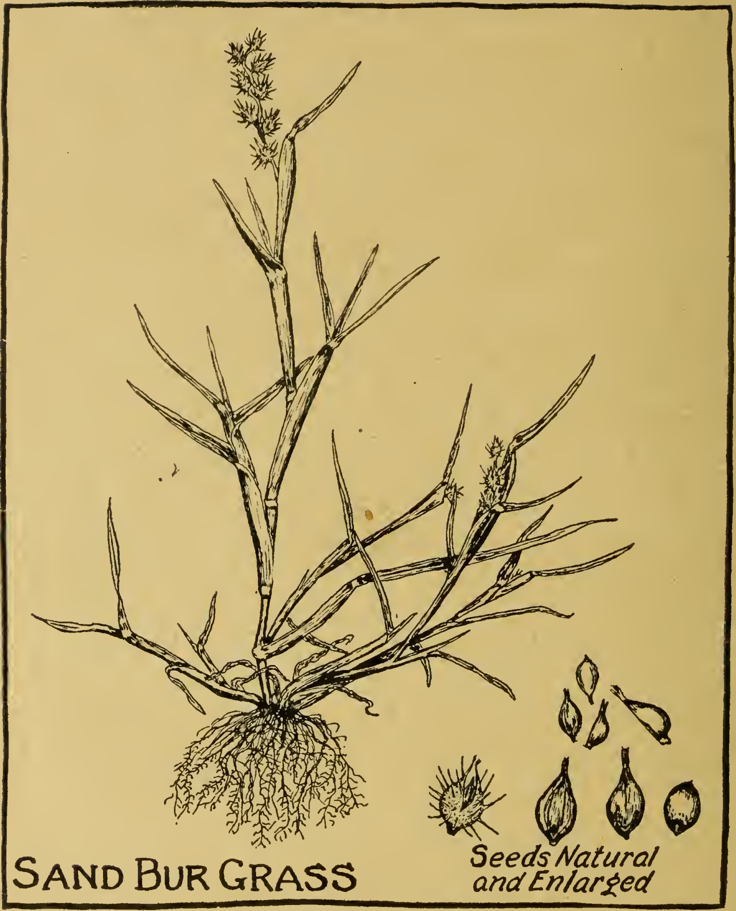


SAND BUR GRASS

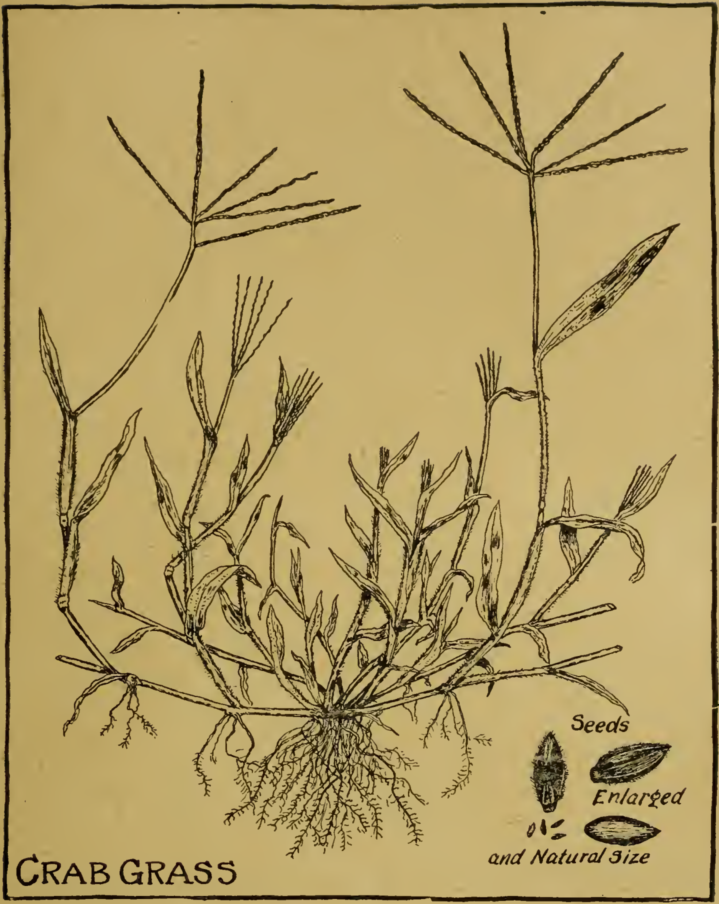
Seeds Natural and Enlarged

Sand bur grass (bear grass, sand spur or hedgehog grass) is a native annual spreading by seeds in burs. It blooms in August and September; seeds in September and October; and is a pest in sandy corn, grain and grass fields and along roadsides.

Description—The roots are fibrous. The stems are from 6 inches to 2 feet tall, round and smooth. Some of them stand erect, others rest on the ground and all of them are more or less branched. The leaves are smooth, from 2 to 4 inches long and from 1/2 to 1/6 of an inch wide. The spikes are stout and consist of spine bearing burs which contain the seeds. The spines become very stiff late in summer and are a source of great discomfort to animals and people.

Spread—The plant is a pernicious weed in sandy lands where it spreads by the blowing of the sand and by the burs clinging to everything with which they come in contact.

Cenchrus tribuloides L.; order Gramineae

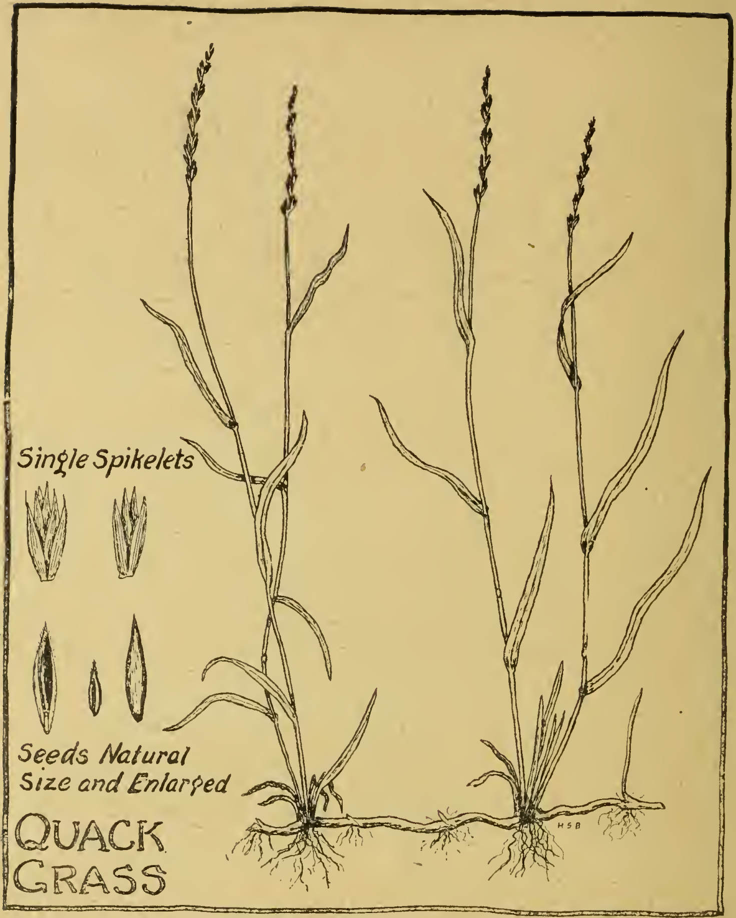


Crab grass (crowfoot grass or finger grass) is an annual, naturalized from Europe and spreads by seeds and stems, rooting at the joints. It blooms from July to August; seeds from August to October; and grows in lawns, gardens and fields.

Description—The roots are fibrous and from 6 to 20 inches long. The stems are from 1 to 3 feet long. Some of the stems rest on the earth's surface and take root at the joints. If the stem is severed from the mother plant a new plant grows from the rooted joint of the severed portion. The leaves are hairy, from 2 to 6 inches long and from 2/12 to 5/12 of an inch in width. The fruit is a small seed-like grain, flattened or slightly shallowed on one face and rounded on the other, making it boat shaped. The back of the fruit has a dark green or purplish cover which may be removed by threshing showing the jet black, shining inner coat.

Spread—This plant is most troublesome in lawns where it is spread by the lawn mower and in gardens and fields. The seeds are found in grass seeds and are spread by the use of these seeds for lawns and pasture purposes. The plants sometimes break loose and roll across the country in the wind, distributing the seeds.

Syntherisma sanguinalis Duloc; order, Gramineae

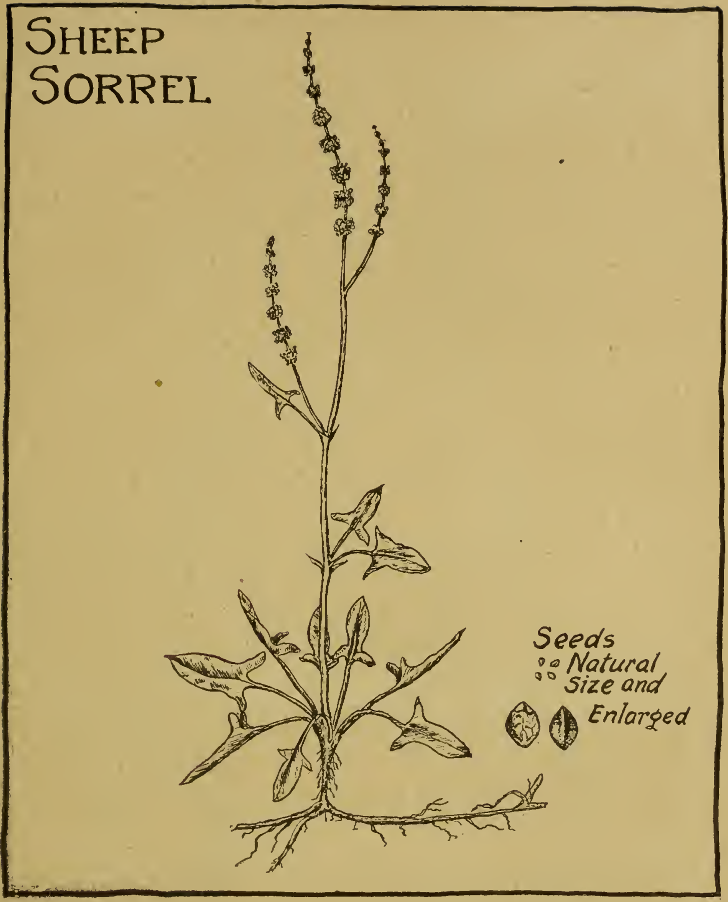


Quack grass (couch grass, wheat grass, scuth grass, twitch grass, dog grass, devil's grass, or whicken's) is a perennial introduced from Europe; and spreads by seeds and rootstocks. It blooms late in june; seeds in July and August; and grows along roadsides, in waste places and fields.

Description—The plants bear underground stems or rhizomes which appear like other stems, except that they are nearly white and the joints much closer together. At all joints fibrous roots develop and at many of them new stems start. A piece of the rhizome bearing one of these joints will produce a new plant. The stems are round and grow to a height of from 1 to 3 feet and the leaves are from 3 to 12 inches long and from ¼ to ½ inch wide. The heads are from 3 to 8 inches long and from ¼ to ½ inch wide, and composed of numerous sections which contain several seeds. The seeds are 1/2 inch long and 1/16 inch wide, nearly yellow in color when ripe and somewhat resemble a small oat kernel.

Spread—The seeds are common in oats, timothy and brome grass seeds, and are distributed in this way. The plant is also spread over the fields by farm tools.

Agropyron repens (L) Beauv; order, Gramineae

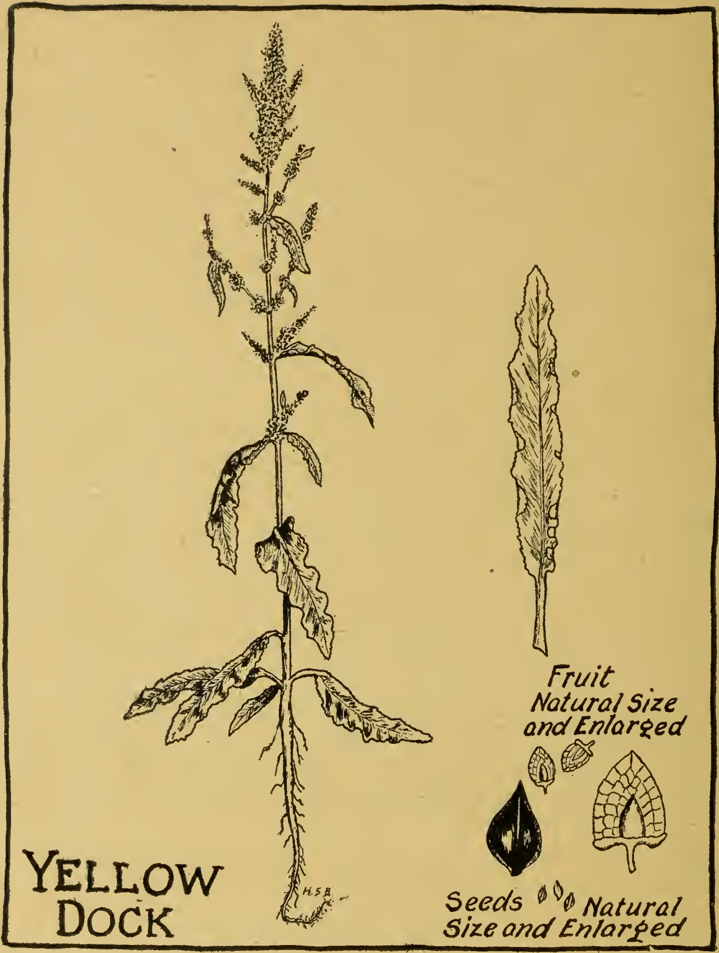

SHEEP SORREL
Seeds Natural Size and Enlarged

Sheep sorrel (horse, red, cow or toad sorrel, sour grass and red weed) is an annual or perennial naturalized from Europe, possibly native also; and spreads by seeds and rootstocks. It blooms from May to September; seeds from July to October; and flourishes on soils too acid for crops.

Description—The true roots are fibrous but the rootstocks are ⅛ of an inch in diameter and of varying lengths. The stems are erect, smooth, from 1 to 2 feet tall. The male flowers are borne on one and the female flowers on another plant and cross pollination is necessary for seed production. The leaves are 1 to 4 inches long and 1 to 2 inches wide. The seeds are triangular about the size of a pinhead and a glistening reddish brown. Often a portion of the flower incloses the seeds giving it a dull, roughened appearance.

Spread—The seeds are very plentiful in white and alsike clover seeds and are separated from them with difficulty. The weed is spread by the use of infested clover seed and by farm tools.

Rumex acetosella L; order, Polygonaceae

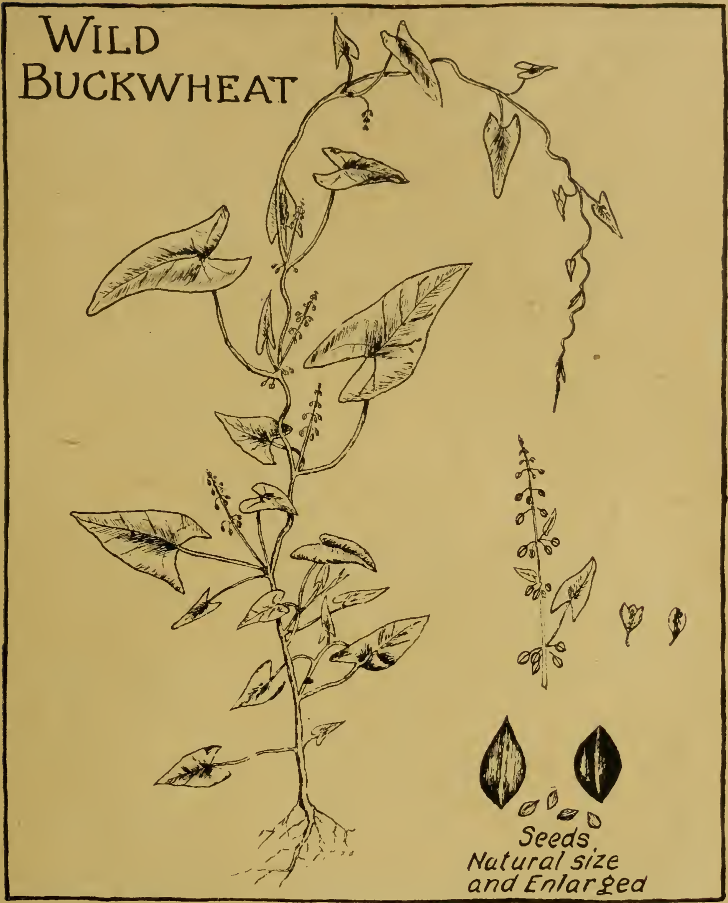

YELLOW DOCK
H.S.B.
Fruit Natural Size and Enlarged
Seeds Natural Size and Enlarged

Yellow dock, (curled dock, sour dock, or narrow-leaved dock) is a perennial introduced from Europe and spreads by seeds. It blooms from June to September; seeds from July to October; and grows in pastures, meadows, farm yards, along roadsides, and in other waste places.

Description—The plant has a bright, orange yellow, deep growing tap root. The stem grows to a height of from 3 to 4 feet, is erect and slightly grooved. The leaves are from 6 to 12 inches long. The flowers are somewhat triangular, greenish and inconspicuous. The seeds are triangular, reddish brown, glistening, about the size of a red clover seed and except where the seeds have passed through a threshing machine are enclosed by three wings, each of which bears a small cork-like swelling which keeps the seed afloat in the water.

Spread—The seed is very common in red clover and alfalfa seeds, through which it is distributed. The seeds bearing the coverings are often carried long distances in streams, and are spread by the spring freshets.

Rumex crispus L; order, Polygonaceae

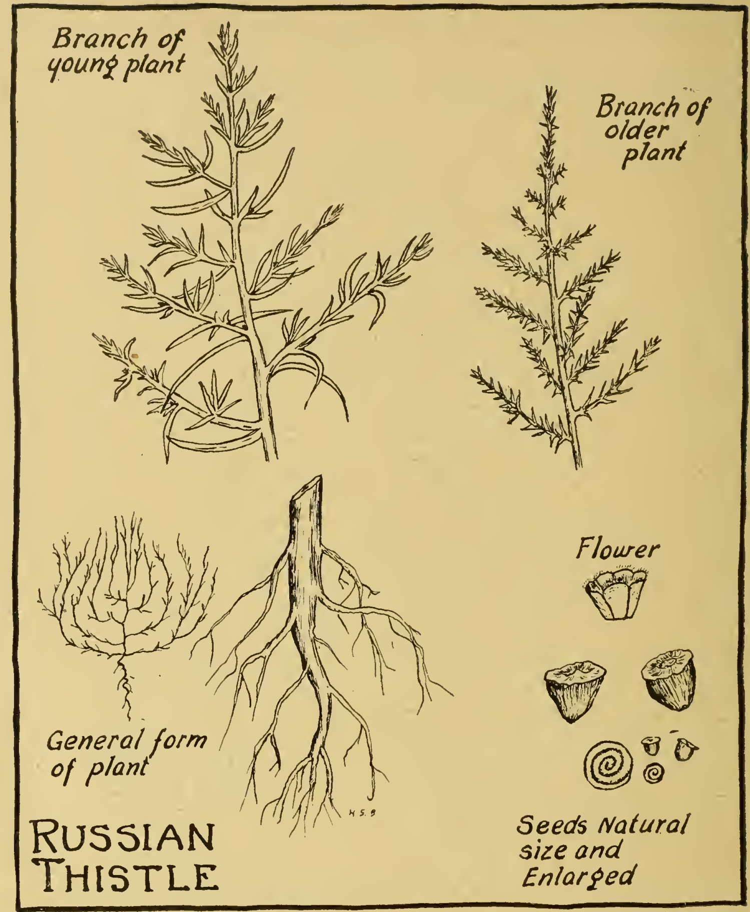

WILD BUCKWHEAT
Seeds, Natural size and Enlarged

Wild buckwheat (knot bindweed, or black bindweed) is an annual introduced from Europe and spreads by seeds. It blooms from June to September; seeds from July until killing frosts arrive; and grows in nearly all crops and in waste places.

Decription—The root consists of a small, shallow growing tap root with many fibrous branches. The stems are from 1 to 3 feet long, somewhat rough and angular. The leaves are from ½ to 3 inches long, ½ to 2 inches wide, thin, smooth, dark green with slender stems, about as long as the leaf blades. The flowers are small and green or pinkish. The seeds are jet black, and about the size of a small buckwheat seed.

Spread—The seeds are common in small grain seeds and the plants are spread by the use of poorly cleaned seeds. Often an abundant crop of seeds is produced in the grain field after the grain has been harvested, and the seeds are carried by the water and by birds to other fields, or plowed under to come up the next time the field is plowed, infesting whatever crop may be on the field.

Polygonum convolvulus L.; order, Polygonaceae

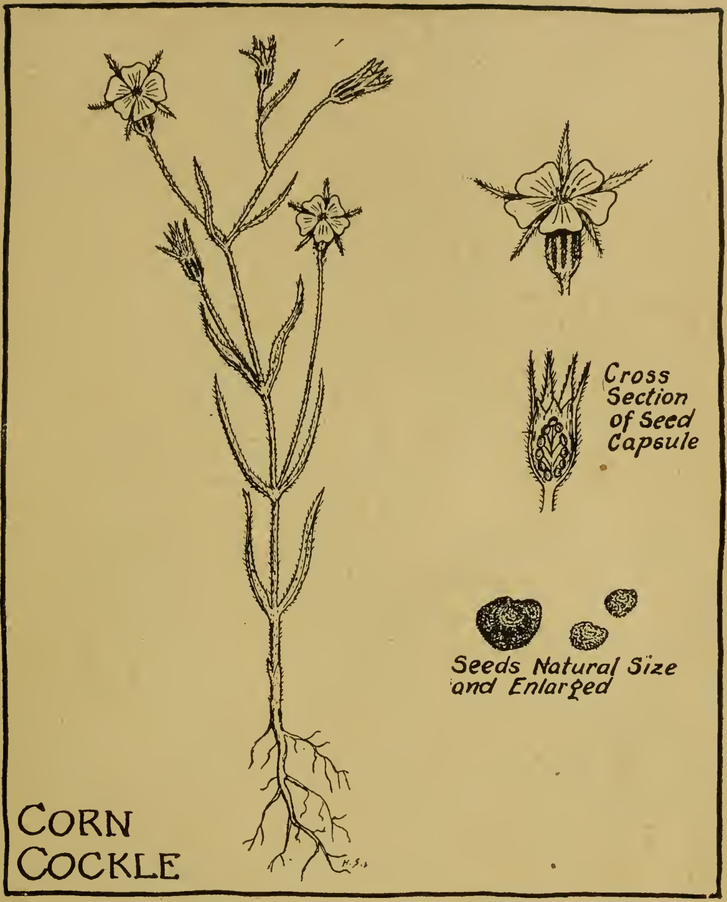


Russian thistle (Russian cactus, Russian tumbleweed, or tumbling thistle) is an annual introduced from Asia and spreads by seeds. It blooms from July to September; seeds from August to November; and grows in dry soil throughout the temperate zone.

Description—The root is from 4 to 10 inches long. The stem is from 1 to 3 feet in height, widely and profusely branched. Early in the growth the stem is green, changing to bright red and then to dark brown or grey. The leaves are from 1 to 3 inches long, usually not more than ¼ of an inch in width. The flowers are borne singly in the angles between leaves and stem; are small, greenish white or pink, and five parted. The seeds are enclosed in the calyx or outer part of the flower which bears short projecting wings. The inner part of the seed is coiled like a bed spring.

Spread—In the autumn the root decays near the surface of the ground; the plant breaks loose and rolls across the country in the wind, distributing its seeds as it goes. The seeds are common in western grown alfalfa seeds, and small grains.

Salsola pestifer A. Nelson; order, Chenopodiaceae

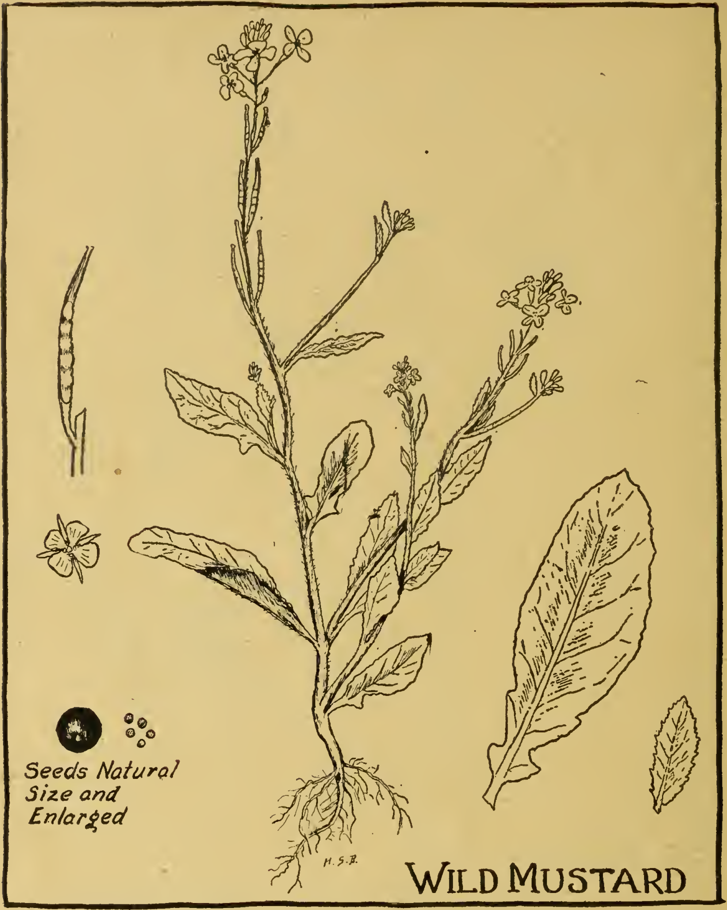

Cross Section of Seed Capsule
Seeds Natural Size and Enlarged
CORN COCKLE
H.S.

Corn cockle (purple cockle, corn rose, corn campion, crown of the field, or mullein pink) is an annual from Europe and spreads by seeds. It blossoms from June to August; buds from August to October; and grows in grain fields.

Description—The root is a rather deep growing tap root. The stem is from 1 to 3 feet tall, usually simple. but occasionally with branches near the top. The leaves are opposite, lance-shaped or linear and from 2 to 4 inches long. The entire plant is hairy, giving it a greyish color. The flowers are about an inch and a half broad, with five spreading reddish-purple petals, slightly notched at the outer edge and darker toward the center. The pod is about ¾ of an inch long and ½ inch in diameter. Their seeds are irregular in shape, rough on the surface and glistening black.

Spread—The poisonous seeds are very common in small grain and vetch seeds. They are especially undersirable because it is extremely difficult to separate them from wheat and grinding them darkens the color of the flour and gives it a bitter flavor.

Agrostemma githago L.; order, Caryophyllaceae

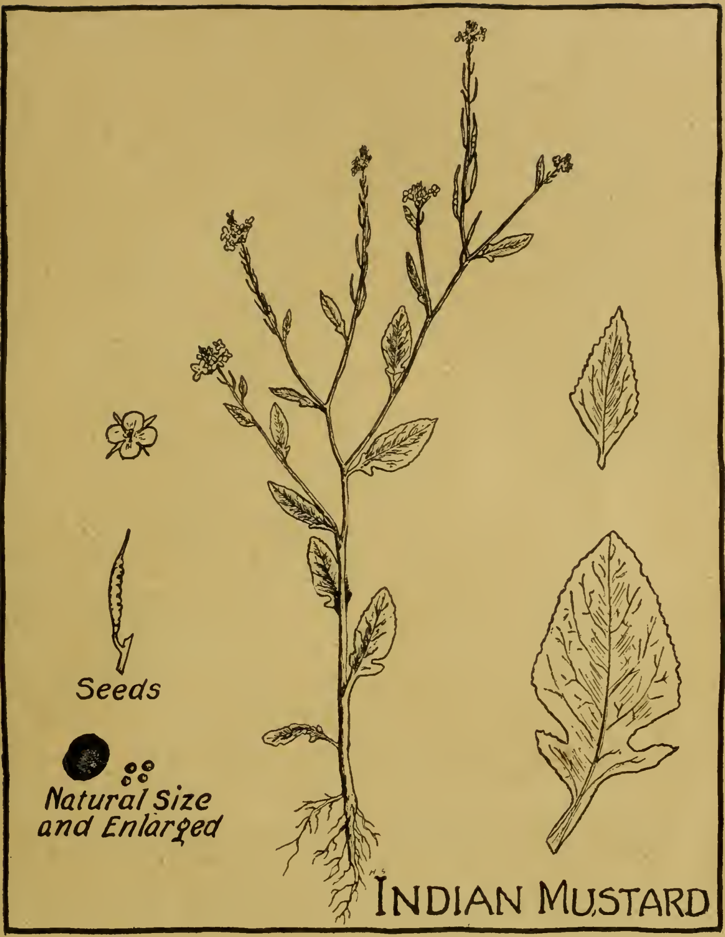

Seeds Natural Size and Enlarged
H.S.B.
WILD MUSTARD

Wild mustard (charlock, kedluck, skillick, herrick and field kale) is an annual from Europe that spreads by seeds. It blooms from May to September; seeds from June to October; and is found in grain and clover fields, meadows and waste places.

Description—The plant has a tap root from 6 to 8 inches long, depending on the soil, and many fibrous branches. The coarse, erect stem is from 1 to 3 feet tall and roughened by stiff downward hairs. There are bright purple spots where the leaves and branches join the stem. The flowers are bright yellow and fragrant. The seeds are found in slender pods from ¾ to 1½ inches long. Ripe seeds are dull black; immature seeds brown.

Spread—The seeds are common in many different crop seeds particularly cereals, alfalfa, and clover. They are spread by the use of poorly cleaned crop seeds. Unground mustard seeds are common in certain ground feeds. Threshing machines also carry them from place to place. It is extremely diffcult to get rid of mustard because each plant bears quantities of seeds and also because the seeds will lie unharmed in the soil for at least ten years.

Brassica Arvensis L. Ktze; order, Cruciferae.

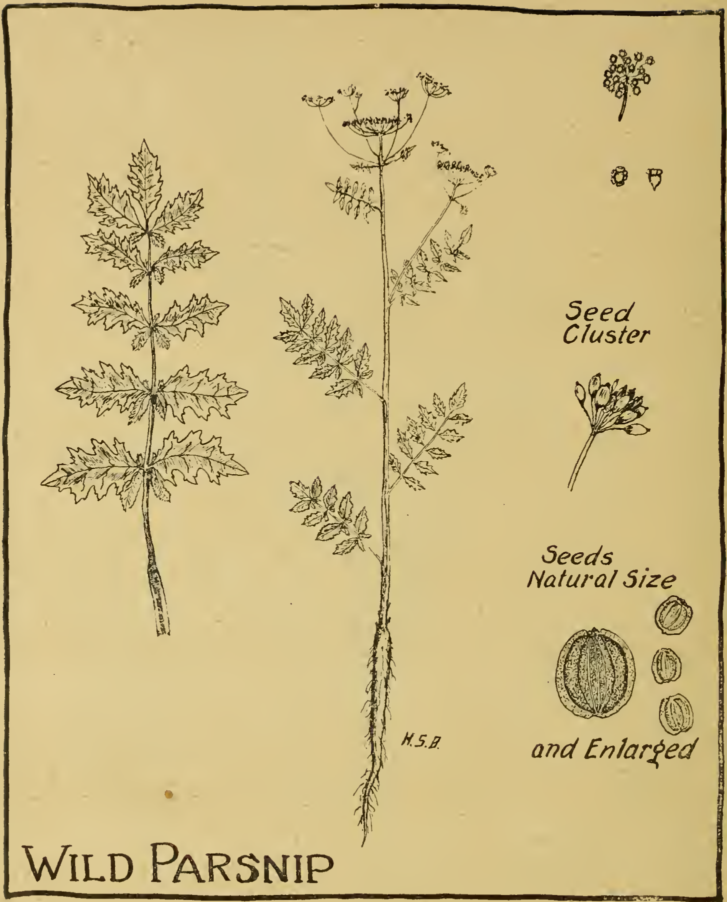


Indian or Chinese mustard is an annual introduced from Asia and spreads by seeds. It blooms from May to September; seeds from June to October; and grows in grain fields, along roadsides and in waste places.

Description—The Indian mustard closely resembles the wild mustard. It has a tap root wth fibrous branches and the stem grows to a height of 1 to 4 feet, but is smooth instead of hairy, and is covered with a whitish powder, giving it a bluish color. The flower is so like that of the wild mustard that it is practically impossible to distinguish between them. The seeds are reddish in color, and prominently veined on the surface.

Spread—In grain grass and clover seeds, by threshing machines and other farm tools and by freshets.

Brassica juncea (L) Cosson; order, Cruciferae

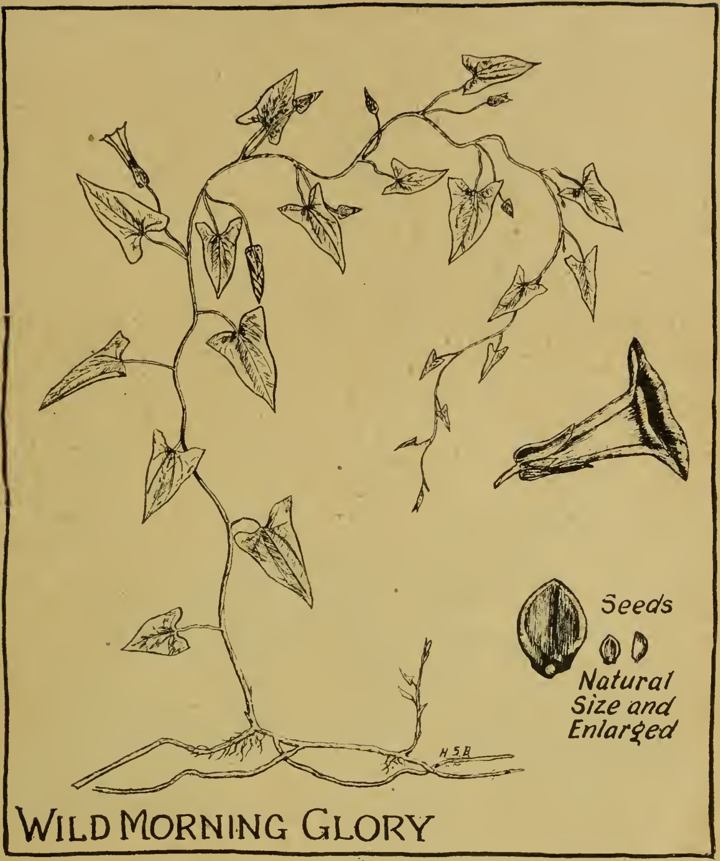


Wild parsnip (field parsnip, madnep, or tank) is a biennial introduced from Europe and spreads by seeds. It blooms from June to August; seeds in August and September; and grows in moist meadows along roadsides and in waste places where it is an unsightly weed.

Description—The root is a deep growing tap root with few branches, from 4 to 8 inches long and near the crown is an inch or more in diameter. At certain seasons of the year the root is a deadly poison. The stem grows from 3 to 6 feet tall; is from a half inch to an inch and a half in diameter, hollow and distinctly grooved. The leaves are from 3 to 10 inches in length. The flowers are small, yellow and five parted. The seeds vary in color from a light to a dark brown and are broadly oval in shape. They are from ⅛ to ¼ of an inch in length and about half that width are surrounded by a thin wing-like margin and closely resemble those of the cultivated parsnip.

Spread—The seeds are produced in abundance and owing to the wing-like formation are carried by the wind. The seeds are not found in cultivated crop seeds, so that the plants spread rather slowly. The most obnoxious feature is the poisonous character of the root.

Pastinaca sativa L., order, Umbelliferae



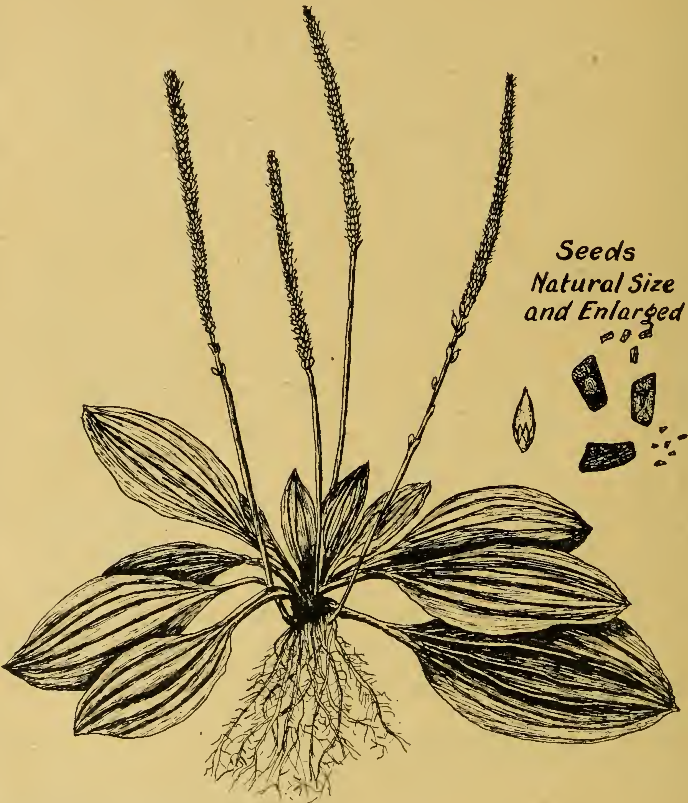
WILD MORNING GLORY

Wild morning glory (field bindweed, bracted bindweed, or hedge bindweed) is a native perennial spreading by seeds and rootstocks. It blooms from June to August; seeds from July to October; and grows in fence rows, thickets, grass lands, and cultivated fields.

Description—The roots are very fine and fibrous and like the stems grow from the long white creeping rootstocks. The rootstocks often extend for several feet through the soil, new plants springing from them. The stems are from 1 to 10 feet long and twine about the grain, corn or other crops and partly or completely smother them. They are round, somewhat grooved, and green or reddish in color. The leaves are about 3 inches long and 1½ inches wide at the base, but tapering to a sharp point at the outer end, are borne on stems from ½ to 2 inches in length and are bright green. The flowers are borne at the stem joints on slender stems, from 1 to 3 inches long. The flower itself is about 3 inches in diameter at the outer end. The seeds are a greyish brown, somewhat roughened, irregular in shape and are borne in a light brown pod, about ½ inch in diameter.

Spread—The seeds are found in small grain seeds. The plants spread most rapidly by farm tools which drag the rootstocks from place to place on the field or farm.

Convolvulus arvensis L., order, Convolvulaceae



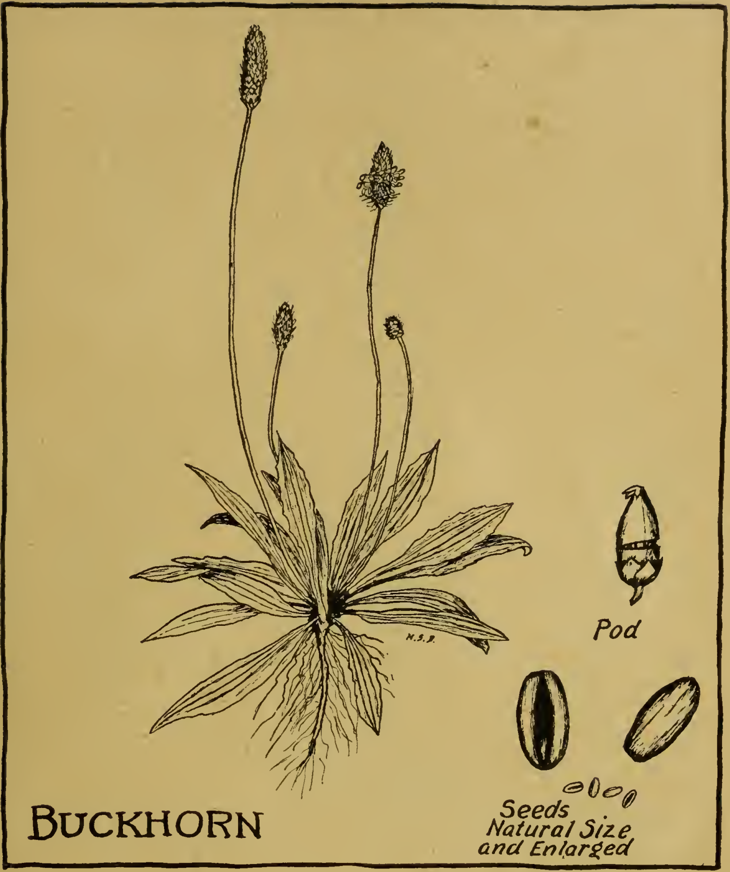
RUGEL'S PLANTAIN

Rugel's plantain (black-seeded plantain, white man's foot, silk plant, or broad-leaved plantain) is a native perennial spreading by seeds. It blooms June to September; seeds from July to October; and infests fields especially grass lands, roadsides and waste places.

Description—The roots are fibrous. The plants are stemless. The leaves are ovate, bright green, with 3 to 11 veins and the bases of the leaf stems are purple. The flower stems or scapes vary from 2 inches to 2 feet in height and bear numerous seed pods in a somewhat open spike. The seeds are very irregular in shape and at maturity are jet black in color. Seeds not fully ripe are brown and may be confused with those of the common plaintain, a closely related species.

Spread—The plaintain seeds are common in grass and clover seeds. Poultry and birds, and washing during storms and freshets help to spread them.

Plantago rugelii Decaisne; order Plantaginacae

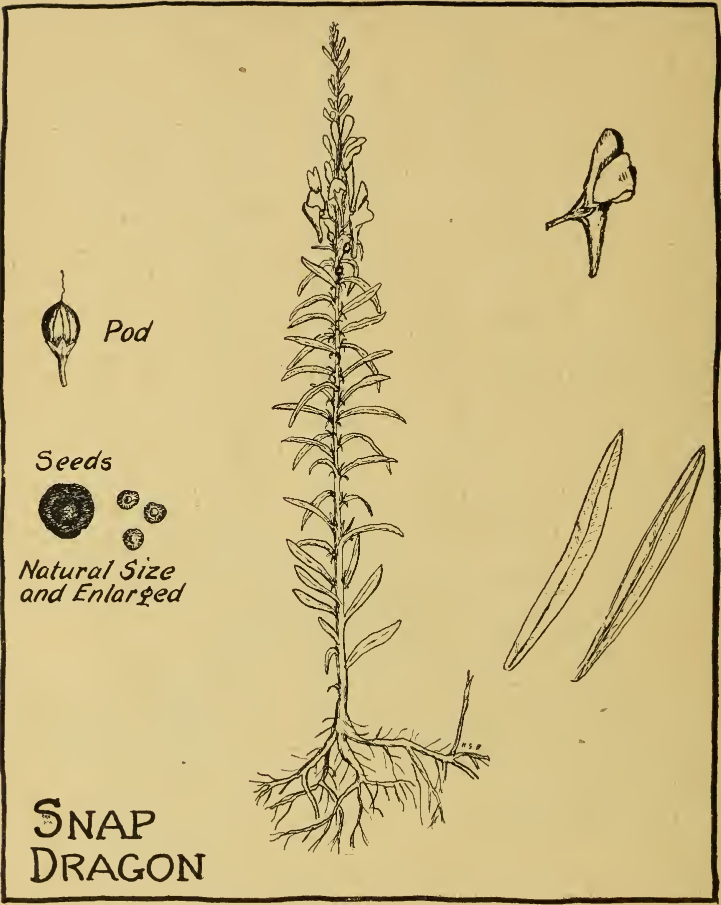


Buckhorn (narrow-leaved plantain, ripple grass, rib grass, ribwort, black plantain, or English plantain) is a perennial introduced from Europe and spreads by seeds only. It blooms from June to November; seeds from July to November; and is found in grassland and poorly tilled fields.

Description—The plant has a short tap root with numerous fibrous branches, and offshoots from the crown which have the appearance of short rootstocks. The plant is stemless. The leaves are lanceolate in shape, parallel veined, dark green above and light below, from 1 to 8 inches long and hairy. The flowers are very small and borne in a spike at the end of a slender, finely grooved, hairy, strong and wiry flower stem from 1 to 3 feet tall. The spikes vary from 1 to 4 inches in length. The seeds are light brown and glistening and are borne two in a pod.

Spread—About a thousand seeds are borne on the average plant and they are one of the worst impurities in clover and grass seeds. Their presence in Wisconsin grown clover seed is causing a marked deduction in price for it, thus doing serious injury to the seed industry of the state.

Plantago lanceolata L.; order, Plantaginaceae

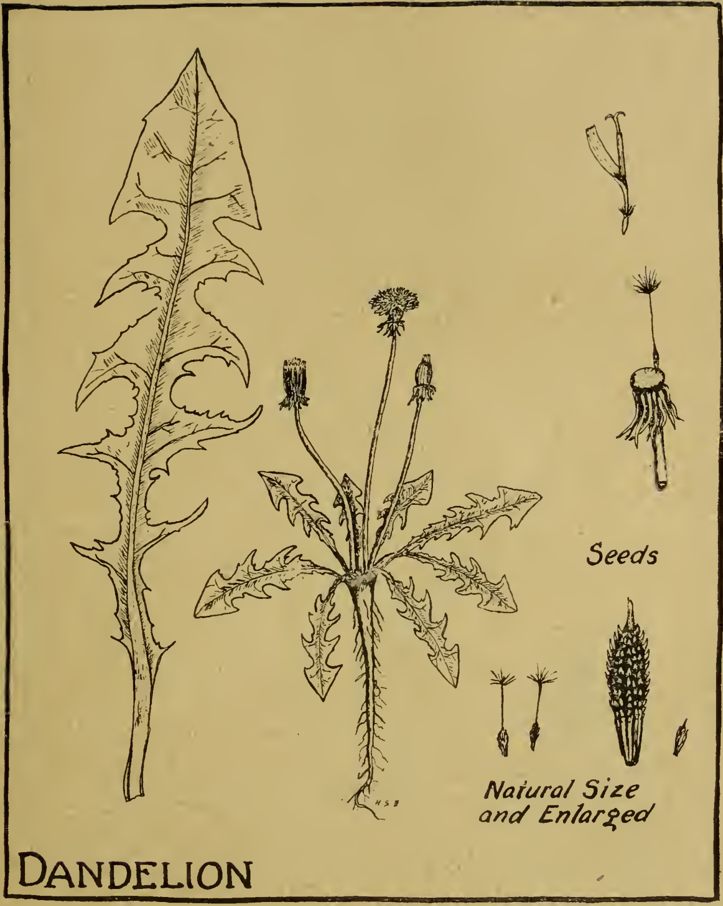


Snap dragon, (butter and eggs, flax weed, eggs and bacon, toad flax or ranstead) is a perennial introduced from Europe and spreads by seeds and short rootstocks. It blooms from June to October; seeds from August to November; and grows in fields, along roadsides and in waste places.

Description—Besides the fibrous roots the snap dragon bears short rootstocks, from which new plants come up. These rootstocks are approximately ¼ of an inch in diameter and white. The stems are from 1 to 3 feet tall, erect, smooth and somewhat wiry. The leaves are from 1 to 4 inches long, alternate, stemless, pale green and waxy. The flowers are about an inch long, bright yellow except for one lobe which is a brilliant orange. The seeds are black, very thin and flat and circular in shape. Each pod is two celled and contains from 50 to 60 seeds.

Spread—The seeds are very light, and blown for some distance by the wind. They also are found in certain grass seeds, by means of which the weed is spread.

Linaria Linaria (L) Karst.; order, Scrophulariaceae

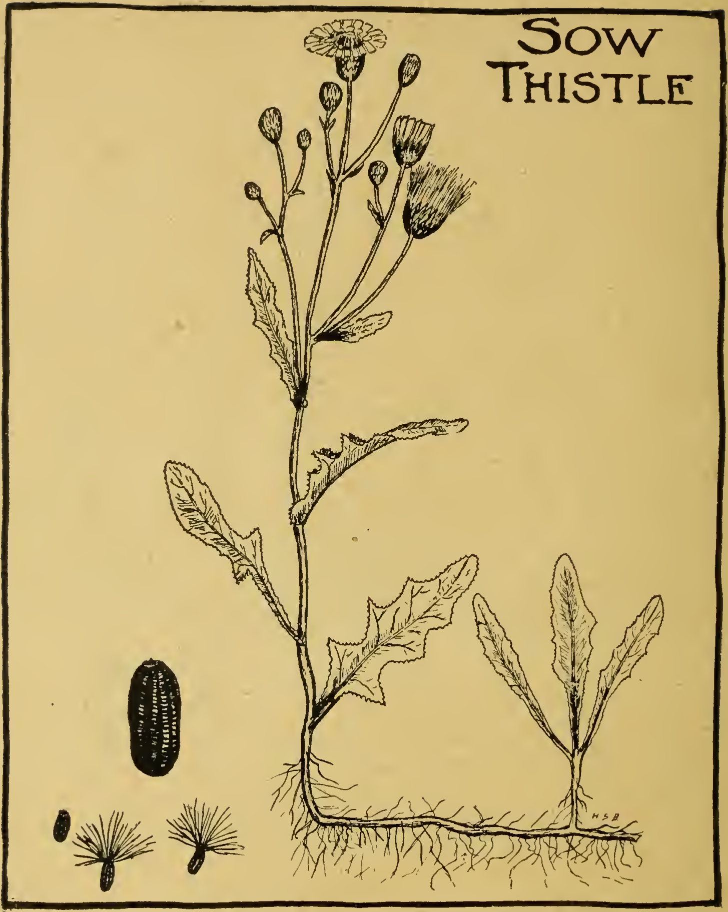


Dandelion (blow-ball, cankerwort, yellow gowan, witch's gowan or milk witch) is a perennial introduced from Europe and spreads by seeds. It blooms from April to September; seeds within two weeks of flowering; and is a pest in the lawns, meadows, and waste places.

Description—The root is a large fleshy, deep-growing tap root, with many fibrous branches. The stem is so short that it cannot be seen. The leaves are bright green and from two to ten inches long. The flower stem is from two to twenty inches tall bearing a bright yellow head. The flowers are very small and are followed by the tan colored fruits.

Spread—The principal means of spread is the wind, although seeds are spread on the lawn by the lawn mower and from one lawn to another by birds and by water. The seeds are often found in grass and rarely in clover seeds.

Taraxacum taraxacum Karst.; order Compositeae

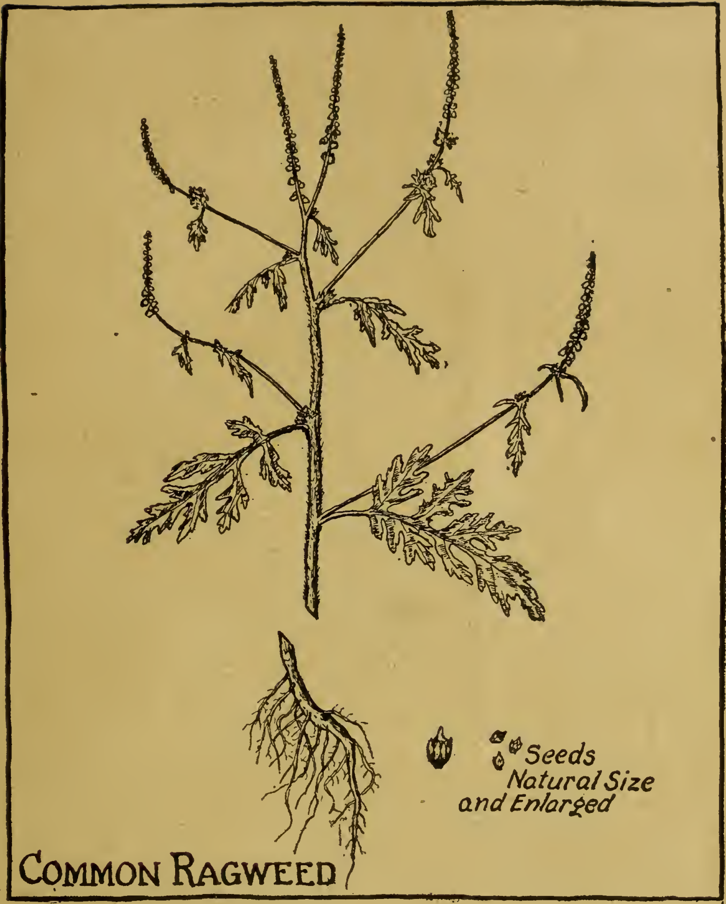


Sow thistle (creeping sow thistle, corn sow thistle, milk thistle, and field sow thistle) introduced from Europe, is a perennial and spreads by seeds and by rootstocks. It blooms from June to August and seeds in July. Grows in grain fields, cultivated crops, roadsides, and waste places.

Description—The true roots are fine and fibrous, projecting from the running rootstocks, which are from ¼ to ⅜ of an inch in diameter and from 1 to several feet in length, depending upon the soil and season. The necessity of destroying the rootstocks makes this a very troublesome weed. The stems grow from 1 to 4 feet tall, are stout, finely grooved and are hollow between the joints. The leaves are from 2 to 12 inches long, clasp the stem, are dark green, smooth, waxy and bear weak spines along the mid rib and on the edges. The flowers are in bright yellow heads and resemble the dandelion. The individual flowers are very small. The seedlike fruit is reddish brown, blunt at both ends, ridged lengthwise and crosswise and about ⅛ of an inch long.

Spread—The seeds are common in certain grass seeds and rare in clover seeds. They spread by the seeds, each of which has a tuft of hairs allowing it to be carried by the wind.

Sonchus arvenis L.; order Compositeae.

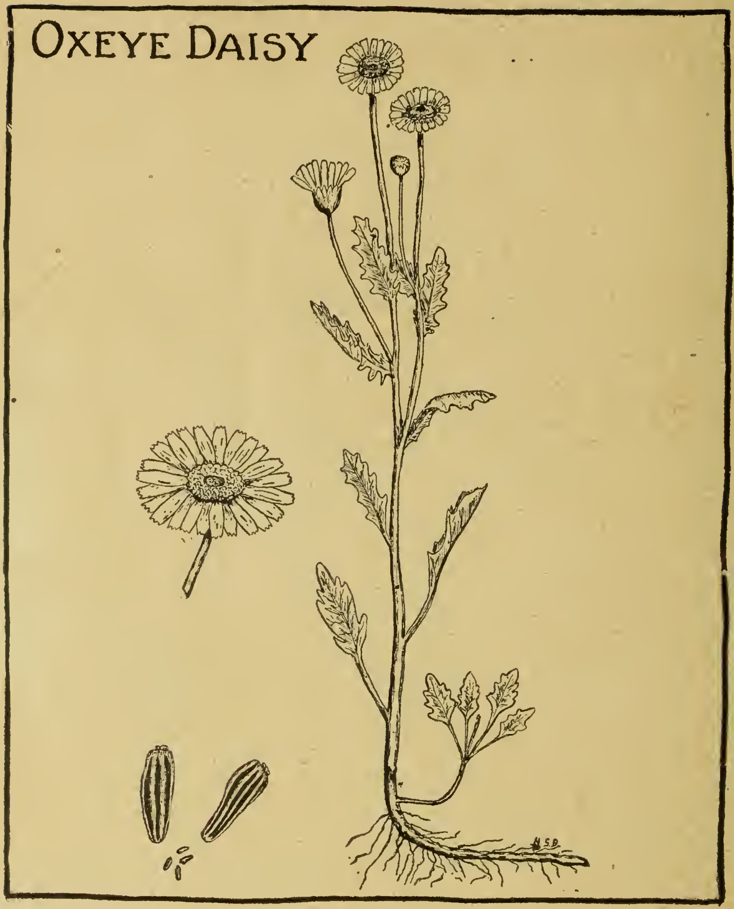


Common ragweed (Roman wormwood, wild tansy, hogweed, bitterweed, stick weed, stammerwort or hay fever weed) is a native annual and spreads by seeds. It blooms from July to October; seeds from August to November; and is abundant in grain fields and along roadsides.

Description—The plant has a slender tap root with fibrous branches. The stems are from 1 to 5 feet tall, slightly hairy, and somewhat rough. The leaves are from 2 to 4 inches long, are hairy, alternate on the upper, opposite on the lower part of the stem and darker color above than beneath. The flowers consist of two kinds, the male flowers at the top and the female flowers between the leaves and stem on the lower part. Both kinds are small, green and inconspicious. The fruits are brownish gray.

Spread—The seeds are often abundant in poorly cleaned grain seeds. They are also common in clover seeds and are spread by the use of these poorly cleaned crop seeds. The seed is protected by a tough outer coat, so that it will lie in the water for some time without injury.

Ambrosia artemisaefolia L.; order, Compositeae

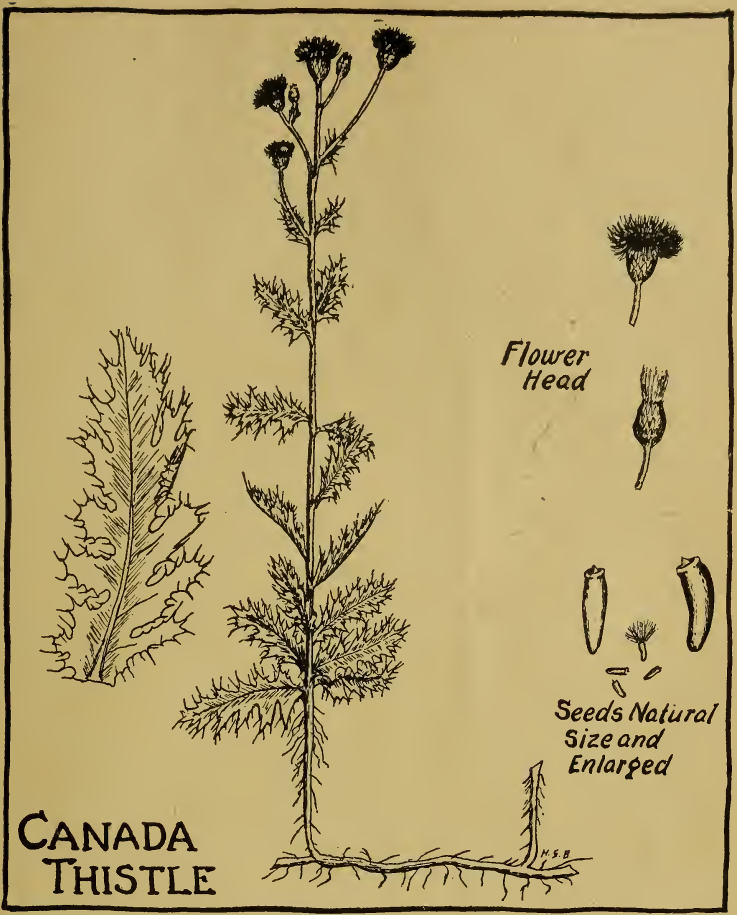


Oxeye daisy (whiteweed, white daisy, or Marguerite) is a perennial introduced from Europe and spreads by seeds and short offshoots from the crown. It blooms in June and July; seeds in July and August; and grows in old fields, meadows, pastures and waste places.

Description—The plant grows from a short, thick and somewhat woody rootstock bearing many small, fibrous roots. There is a slow but steady spread through the rootstocks. The stems are erect, slender, from 1 to 3 feet tall, and they are finely grooved. The root leaves grow in dense tufts or mats and may smother other vegetation. The stem leaves are more narrow. The flowers are borne at the summits of the stems in heads from 1 to 2 inches in diameter. The seeds are very numerous, about three-eighths of an inch in length.

Spread—The seeds are common in alsike and white clover and various grass seeds and are distributed through their use.

Chrysanthemum leucanthemum L.; order Compositeae


Flower Head
Seeds Natural Size and Enlarged
CANADA THISTLE
H.S.B

Canada thistle (creeping thistle, way thistle, corn thistle, cursed thistle, or soft field thistle) is a perennial, introduced from Europe and spreads by seeds and by running roots. It blooms from June to August; seeds in July and August and grows in meadows, pastures, fields, groves and along roadsides and fences.

Description—The root consists of two distinct parts, one extends vertically into the ground, the depth varying with the character of the soil. Extending from this are running roots about ⅜ of an inch in diameter and growing sometimes to be several feet long. New plants may grow anywhere on the running root. The stem is from 1 to 3 feet tall and is marked by fine longitudinal lines. The leaves are from 3 to 8 inches long, slightly clasping at the base. The upper surface is bright green and the lower greyish green. Stiff yellowish spines are borne along the edges and on the mid rib. The flowers are purple, very small and borne in a head an inch or more in length and from ½ to ¾ of an inch in diameter. From each of these comes a small seedlike fruit bearing a tuft of hairs.

Spread—The seeds of the Canada thistle are very prevalent in and very hard to remove from alsike and white clovers and grass seed When the thistles have once become established, they spread very rapidly, not only through the crop seeds mentioned, but by the wind which carries them from field to field or from farm to farm.

Carduus arvensis Robson; order, Compositeae

Weeds Mean Loss

THEY lower the selling price of land. It costs from $16 to $25 an acre to eradicate them.

They reduce crop yields. They rob the crop of food and water. They shade and dwarf the crop and spoil the quality.

They increase cost of harvesting by extra wear and tear on machinery, heavier draft on horses, requiring extra twine, and by twining about grain and corn causing trouble in binding and shocking.

They are responsible for the shrinking of the grain, weed seeds in the threshed grain, and bad flavors in dairy products, thus causing a reduction in the selling prices.

They reduce the net profit by all the above and by poisoning livestock, by unnecessary taxes, and by requiring an immense amount of labor to control.

Published and distributed under Act of Congress, May 8, 1914 by the Agricultural Extension Service, College of Agriculture of the University of Wisconsin, K. L. Hatch, Assistant Director, the United States Department of Agriculture cooperating.

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May, 1924

The Story of the Babcock Test

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Babcock Helped to Make Dairying a Better Business

"By means of the Babcock test, dairying has been developed from one of the most haphazard of industries to an exact and attractive business enterprise. The Babcock test has been so intimately connected with, and largely responsible for, the progress in dairying not only in this state but throughout the country and the world, that proficiency in its use has become almost synonymous with better cows, better milk, and better farming.

"It has served as the necessary stimulant to raise dairying from a disliked side line to a profession worthy of the efforts of well trained men. It has made dairymen more honest, has placed dairying on a scientific basis, has promoted factory efficiency and has stimulated the development of productive herds.

"The Babcock test has struck the shackles which bound dairy farmers to past traditions, and has started them on their way to greater prosperity."

H. L. RUSSELL,
Director.

The Story of the Babcock Test

J. L. Sammis

GUESSWORK ruled dairying until 1890.

The invention of the Babcock test provided a simple, accurate method for measuring the richness of milk or cream. It was commonly believed that 100 pounds of milk from one cow would make just as much butter or cheese as an equal amount from any other cow. Cows were valued for their bulk milk production. Quantity, not quality, counted.

The story of the perfection of this test is an interesting one, laid in the chemical laboratory of Dr. Stephen Moulton Babcock, at the early beginning of scientific dairying.

In 1889 there was no reliable method of milk analysis, except the time consuming and expensive chemical method which could not be used on the farm or in the factory.

The experiment stations of the country, which for the most part had just been established by Congress under the Hatch act of 1887, saw in this problem an opportunity to render service. The appeal of the factory operators was made especially to them to devise some method that would answer the question on which further dairy progress seemed to depend. Several different methods were worked out between 1888 and 1890, that were named for their inventors, as follows: Short's,[2] Parson's,[3] Failure and Willard's,[4] Cochran's,[5] and Patrick's[6] tests. One of them, Short's test, was developed at this station.

In nearly all of these tests, the fat was separated by heating the milk with acids or alkalies, to dissolve the solids not fat; and the melted fat was either separated by gravity, or dissolved in ether or gasoline and measured on a percentage scale. These tests all gave fairly accurate results for whole milk or cream, but were not very satisfactory for factory by-products as skimmilk or buttermilk. Although they were put into operation in a number of creameries and served as a basis of payment, they were too complicated and not accurate enough to give satisfaction.

Dr. Babcock Invents Test

The importance of dairying in Wisconsin made it natural for this Station to push vigorously the work begun by Professor Short, who was

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[1] The author is indebted to H. L. Russell, author of "The Coming of Age of the Babcock Test," for much of the historical data on the test given in this circular.

[2] Wis. Expt. Sta., Bul. 16, July, 1888.

[3] Rpt. New Hampshire Expt. Sta., 1888, p. 68.

[4] Amer. Jour. Anal. Chem., III, 1888, p. 295.

[5] Amer. Jour. Anal. Chem., III, 1889, p. 381.

[6] Iowa Expt. Sta., Bul. 8, Feb. 1890.

then assistant chemist here. At the earnest request of Dean Henry, Dr. Babcock took up the problem to see if further improvements might be made. He developed a number of different methods which worked fairly well, but as they did not seem to be of universal application, they were discarded by him and no publication was made.

One of these tests is of special interest, since it shows the final steps in the development of the Babcock test. In this method, the milk was made strongly alkaline and ether added, as in Soxhlet's aerometric method. The separation of the ethereal solution of fat was facilitated by the use of a centrifugal machine, after which the ether was evaporated and the fat measured. The whole operation was conducted without transfer, in bottles similar to those now used in the Babcock test. At first the ether was evaporated by gradually warming the bottles in a water bath, but it was necessary to do this slowly, and this demanded constant attention to avoid loss of fat by frothing of the liquid. It was found, however, that the ether could be completely driven off in a short time, without any frothing, if the bottles were heated by a jet of steam, while being slowly revolved in the centrifuge. The bottles were afterwards filled with hot water to bring the separated fat into the graduated neck where it was measured. The method was accurate and applicable to the estimation of fat in whole milk, cream, skimmilk, buttermilk, and whey.

Sylvia Proved Stumbling Block

Hundreds of tests were made by this method, with mixed milks and with milks from individual cows, all of which were satisfactory, except in the case of milk from one cow (Sylvia) of the Station herd. The results obtained with the milk of this cow, a Jersey of good size and normal in every particular, did not check with the detailed gravimetric chemical method of analysis.

It was urged upon Dr. Babcock that this case was exceptional and ought not to prevent the publication of the method, since it would be used chiefly for testing mixed milk with which satisfactory results were always obtained. He, however, opposed absolutely the recommendation of any method for general use, with which he could not secure correct results from every cow in the Station herd. Thus, Sylvia killed the first Babcock method. Many attempts were made to overcome the difficulty by use of other reagents.

Finally it was found that when sufficient concentrated sulphuric acid was added to the milk to dissolve the precipitate that first forms, and ether afterwards added, the test being completed as before, that all of the fat could be recovered in every case. Later, it appeared that equally accurate results could be obtained by increasing the quantity of sulphuric acid, and omitting the ether. The acid rendered soluble all solids not fat, while the heat evolved in the mixture melted the fat, allowing it to rise to the surface. When such a mixture was subjected to moderate centrifugal force, the fat was gathered in the narrow graduated neck of the containing bottle where the percentage of butter fat could be immediately determined by inspection. This method was applicable not only to whole milk and cream, but equally so to all of the by-products of the factory.

Easy To Operate

It was simple and inexpensive to operate, could be used by any careful person, and a complete test could be made in five minutes. It is noteworthy that so completely was every detail worked out before it was placed in the hands of the public that no change has been made in the essential features of the test. The mode of measuring the milk, the volume of the sampling pipette, the character of the test bottle, and the technique of the operation remain today the same as they left Doctor Babcock's hands twenty-four years ago. The mechanical make-up of the apparatus has of course been improved. The centrifuge as constructed today is lighter and can now be operated by hand, steam or electric power.

Harmful Modifications Discarded

Soon after the test was invented, dairy supply houses sent out simpler and lighter machines, but many of these were too frail to stand hard usage, and some criticism against the method was occasioned by these defective mechanical devices. When first proposed, the machines were constructed for hand power, but in factories the use of power machines of a turbine type and in large sizes, permitting the simultaneous testing of twenty-five to thirty samples, has now become well nigh universal where the test is employed.

When the method was published, many creamerymen objected to the test, because the results were expressed in terms of butter fat instead of butter. The manufacturers of dairy apparatus attempted to meet this objection, by putting on the market larger pipettes for measuring the test samples of milk. These pipettes were designed to account for the "over-run" that would naturally be produced in the butter, but uncertain results and confusion in the factories occurred, and again the test suffered considerable discredit because there was no standardized glassware. The earnest protest of this Experiment Station was finally heeded by the manufacturers, and for the past fifteen years supply houses have adhered to the original specifications laid down. This movement was accelerated in a number of states by legislative enactments, fixing standards for the graduation of the test glassware.

As fat is the milk constituent present in the largest proportion in cheese, the yield of cheese is more closely related to the percentage of fat in milk than to the percentage of any other one milk constituent.

The straight fat method of payment then gives payments closely proportional to actual cheese yields, and should be used at the great majority of all factories, as it is at present.

The proposed modified methods such as fat plus casein, fat plus 2, fat plus .6 have all been discarded at the great majority of factories for reasons given above.

Only at a few factories where both Holstein and Guernsey or Jersey cows are kept can the correctness of the straight fat method be called in question. Thus in all essentials generally, the Babcock test and its applications stand today as originally described by its inventor.

Spread of Test in Dairy Regions

The Babcock method is now recognized throughout the leading dairy sections of the world. It has been adopted as a standard method by the Association of Official Agricultural Chemists and in the factories of the United States and Canada has completely superseded all other fat tests. It is practically the only test used in Australia, New Zealand, and South Africa, and has been introduced into Argentina in South America. In Australia and New Zealand it was generally adopted as a basis of payment for milk even earlier than in the United States. In England it is used considerably, although the Leffmann-Beam modification is more generally employed. The Gerber test is dominant in Germany and Denmark, but the Babcock method is used to some extent in Finland, Russia, and Northern Germany. While this record shows its practical predominance over the major portion of the dairy world, its effect on dairy advancement is of general historical interest.

It is noteworthy that an invention of a machine or a method sometimes transforms an industry and exerts an influence that is historically of the greatest importance. Eli Whitney's cotton gin was an economic factor in the development of the Civil War. The impetus it gave to cotton culture made possible the industrial development of the South, and the inevitable result was the expansion of slavery. The evolution of the twine binder paved the way to the settlement of the illimitable stretches in the valleys of the Missouri, the Saskatchewan, and the Red River of the North, converting these prairies that were once a part of the great American desert of our boyhood geographies, into the granary of the world. Just as the economic and even the political history of the great northwest may be written in terms of wheat, made possible by the invention of a device to garner the grain, so the Babcock test and the cream separator are the two inventions in the dairy world that have determined the course of dairy advancement.

Dairying Needed This Test

The economic needs of a business greatly stimulate invention. The McCormick reaper, the Marsh harvester and the Appleby knotter of the twine binder were all produced by the stimulus which economic necessity made apparent. The development of the railroad made necessary the invention of the telegraph, by which trains could be safely dispatched. Cooperative dairying, stimulated by the invention of the centrifugal cream separator, needed a method of precision like the

Babcock test to measure milk values. If Dr. Babcock had not succeeded when he did in producing the simplest and most effective test, some other name would soon have been associated with a test, for under the stress of economic pressure, it had to come.

In the maintenance of soil fertility through dairying in Wisconsin and what this means to the commonwealth, the Babcock test has had no small share. Without it or its equivalent, cooperative dairying in the associated factory system would have fallen by the weight of unscrupulous practices.

As Ex-Governor Hoard has said, it has made dairymen more honest than has the Bible, because it has removed all opportunity for them to profit by any deceit or cheating. It has placed dairying on a scientific basis, in that it has been the instrument through which it has been possible to improve factory efficiency, and to "breed up" the quality of individual herds by selection.

Influence on Dairy Education

The Babcock test can well be called "The Founder of Modern Dairy Education." To train the factory operator how to use the test properly it was necessary to give him specific instruction. This need was apparent the moment the test was devised. In the winter of 1890, a few months after the test had been made public, the Wisconsin Dairy School, the first school for dairy education in America, opened its doors. Its first session was attended by two pupils. The next winter, seventy were crowded into a little room in an old wooden building at the University farm, the instruction being given by Dr. Babcock and H. B. Gurler, now of Macon, Miss., who was the first practical dairyman in America to use the test.

Recognition of Dr. Babcock's Services

The commonwealth has gladly acknowledged her obligation to the man who made this development possible. The legislature of 1899

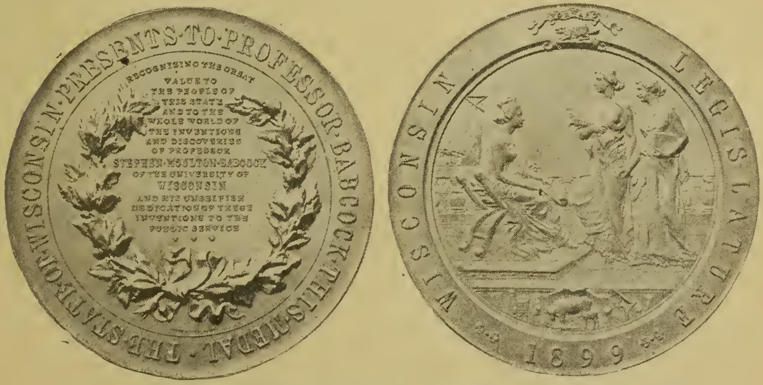
THE·STATE·OF·WISCONSIN·PRESENTS·TO·PROFESSOR·BABCOCK·THIS·MEDAL·
RECOGNIZING THE GREAT VALUE TO THE PEOPLE OF THIS STATE AND TO THE WHOLE WORLD OF THE INVENTIONS AND DISCOVERIES OF PROFESSOR STEPHEN·MOULTON·BABCOCK OF THE UNIVERSITY OF WISCONSIN AND HIS UNSELFISH DEDICATION OF THESE INVENTIONS TO THE PUBLIC SERVICE
WISCONSIN LEGISLATURE
1899

FIG. 1.—MEDAL PRESENTED BY WISCONSIN LEGISLATURE

passed a joint resolution providing that a medal be presented to Dr. Babcock as a testimonial of his service to the state. This medal, designed and struck by Spinx & Son of London, was selected by a special legislative committee appointed for this purpose and was presented to him during the session of the Legislature of 1901. The medal bears the following inscription, "Recognizing the great value to the people of this state and to the whole world of the inventions and discoveries of Professor Stephen Moulton Babcock of the University of Wisconsin, and his unselfish dedication of these inventions to the public service, the State of Wisconsin presents to Professor Babcock this medal."

In 1900 the dairymen of New Zealand presented Dr. Babcock with an illustrated testimonial containing a number of water colors of New Zealand scenes. In 1901 a similar testimonial in the form of an oil painting, representing an Australian dairy scene, was received from the dairymen of the provinces of Victoria and New South Wales.

The original test machine was exhibited at the World's Columbian Exposition at Chicago in 1893, at the Paris Exposition in 1900, at the Pan-American Exhibition at Buffalo in 1901, and at the Louisiana Purchase Exposition at St. Louis in 1904. The highest honor, "The Grand Prize," was awarded the Babcock test at both the Paris and St. Louis Expositions.

How to Use the Test

The dairyman who buys and uses a Babcock tester will soon find that he is aided in three ways: first, by testing his cows he will be able to weed out the "robbers" and retain his best producers for breeding, and milk and butter fat production; second, by frequently testing the milk or cream before it is sold he should have a check upon the test made at the factory; third, by occasionally testing the skimmilk he will be able to see that no butter fat is being wasted.

On many dairy farms the Babcock test is saving annually many times its cost, and at the same time is enabling farmers to select their best cows and improve their herds as rapidly as possible. A Babcock tester should be used regularly on every dairy farm and in every rural school in the state.

Principal Steps in the Babcock Test

1. Mix the milk thoroughly and take out a small sample.
2. Do not let the sample evaporate or curdle before testing.
3. Fill the 17.6 cc. pipette to the mark with milk.
4. Empty the pipette without loss into a Babcock test bottle.
5. Add sulphuric acid from the measuring cylinder to the test bottle.
6. Mix the acid and milk thoroughly by shaking the bottle.
7. Place bottles in the centrifuge, cover and whirl 5 minutes.
8. Add hot water and whirl again twice, one or two minutes each time.
9. Read and record the per cent of fat in the neck of the test bottle while yet hot.
10. Empty the test bottles and wash thoroughly.

Mixing and Sampling Milk

Provide a quart or more of milk, with which to practice sampling and testing. Mix it thoroughly by pouring several times from one vessel to another, or by stirring vigorously. Larger quantities of milk require more stirring. While the milk is still in motion, dip out half a teacupful and pour this at once into a small, clean, dry bottle. Fill the bottle nearly full, and stopper tightly to prevent evaporation. After stirring the milk again for a short time, take out another sample, place it in another bottle and stopper tightly as before. If the milk was thoroughly mixed each time, these two samples will show exactly the same per cent of fat by the Babcock test. Label each sample bottle with the name of the cow or owner.

The small sample taken for the test must contain exactly the same proportion of fat as the entire contents of the pail or can. If milk stands quiet for even a few minutes, the cream will begin to rise, and the top layer of milk will contain more fat. If the top part is used for the test, it will indicate a higher per cent of fat than is present in the entire lot of milk. It is incorrect to take a sample for testing out of a pail, can or bottle without first thoroughly mixing the milk by stirring, or pouring it from one vessel to another. When two persons get different results in testing any lot of milk, it is usually because one or both of them did not stir the milk long enough to get it thoroughly mixed before taking the sample. In any case where the accuracy of the results must be proven, it is important that two or more separate samples be taken at different times while stirring. Each sample should then be tested by itself. If the results differ, it shows some error in the work, and if the difference is over one-tenth of one per cent, the sampling and testing should be repeated in a more careful manner.

Preserving Samples

If it is necessary to keep the milk samples several hours or days before testing, a preservative should be added to prevent curdling, and the bottles should be kept tightly stoppered. The preservative most commonly used is corrosive sublimate, which is a poison. It is sold in tablet form, in boxes containing 100 or 1,000. Each tablet also contains some pink coloring matter, so that everyone may know that the milk, so colored, contains poison, is unfit to drink, and must not be fed to stock. For half pint or smaller samples, add one small preservative tablet to each bottle of milk and shake until dissolved. Formalin and bichromate of potash are other preservatives which may be used instead of the tablets. All these are poisonous and must be kept out of the reach of children.

Filling the Pipette

The milk test bottle and pipette (Fig. 2) are cleaned with hot water and if necessary with a brush and washing powder or soap, and thoroughly rinsed with clean water before using.

Before taking any milk out of the small sample bottle with the pipette the sample bottle should be well shaken, so as to mix the cream all through the milk. It should be remembered that cream is always rising in milk. If cream sticks to the side of a sample bottle, or if lumps of butter fat appear on the surface of the milk after shaking, warm the bottle and contents to about 100° F., and shake again. Immediately put the narrow tip of the pipette into the milk (while it is still in motion); and, with the mouth, suck air out until the milk rises in the pipette, above the mark on the neck. Quickly place the forefinger over the upper end of the pipette, before the milk runs down below the mark. If the finger is dry or nearly so, it is easy, by changing the pressure on the end of the tube, to let the milk run down slowly and to stop it exactly at the mark.

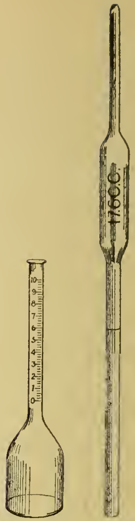

Fig. 2—A pipette holding 17.6 cc. milk and a test bottle for milk, used in the Babcock test.

Filling the Test Bottle

The tip of the pipette is placed in the top of a test bottle, held in an inclined position, as shown in Figure 4, and the milk is allowed to run down one side of the neck of the bottle, without filling the neck completely, or preventing the escape of air. In this way exactly 18 grams (17.5 cc.) of milk are transferred to the test bottle without loss. It is well for all beginners to practice filling the pipette with water until the flow can be readily controlled with the forefinger. If a portion of the milk containing preservative should ever be drawn into the mouth, spit it out and rinse the mouth with clean water. After the samples of milk have been placed in the test bottles, they can be set aside for a day or a week, if necessary, and the test can be finished at any time without affecting the result.

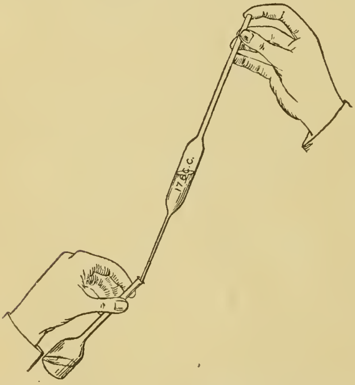

Fig. 3.—On slowly releasing the pressure of the finger at the top of the pipette, the milk runs, without loss, into the test bottle.

The milk in the test bottle should not be warmer than 60-70 degrees Fahrenheit, just before the acid is added.*

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* For this reason, milk fresh from the cow, skimmilk or cream from the separator, or whey from the cheese vat must be cooled before acid is added. For cooling, the test bottles may be stood in a refrigerator or shaken in cold water for a few minutes, before adding acid. Probably more tests are spoiled by having milk or acid too warm than by any other one cause.

Adding the Acid

Sulphuric acid, of specific gravity about 1.82, sold for the Babcock test, can be obtained at any drug store or from dealers in dairy supplies. Keep the supply of acid in a refrigerator or other cool place, so that it will always be ready for use. The acid, at about 60-70° F., is measured in the little acid cylinder, shown in Figure 4, which, when filled to the mark holds just 17.5 cc.

The cylinder is then emptied into the test bottle, which is held in an inclined position, as shown in the figure, to permit escape of air, and to avoid spilling the acid. Since this acid destroys wood and nearly all metals, the bottle of acid and the little measuring cylinder should be kept standing on a brick, a piece of stone, or a piece of sheet lead. Liquids containing sulphuric acid should not be thrown where live stock can come in contact with them, but can be poured with safety into an earthern jar or into a clay drain tile set on end in the ground. The sulphuric acid bottle should be kept stoppered because the acid readily absorbs moisture from the air and thus becomes weakened. Always add acid to milk in bottle and never add milk or water to the strong acid.

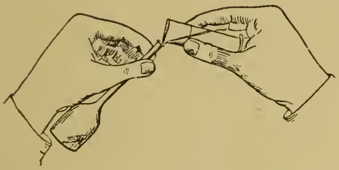

Fig. 4.—In pouring acid into the test bottle incline the bottle a little to avoid spilling acid on the hand.

As sulphuric acid will quickly eat holes in clothing and cause blisters on the skin, the greatest of care should be taken so as not to spill it. To observe its effect, put a few drops of acid on each of two pieces of paper, or cotton or woolen cloth. With a little water, rinse the acid as quickly as possible from one piece, and note whether it is spotted where the acid fell. Leave acid on the other piece for a few minutes and then wash it. Do not get acid on fingers. Wash it off

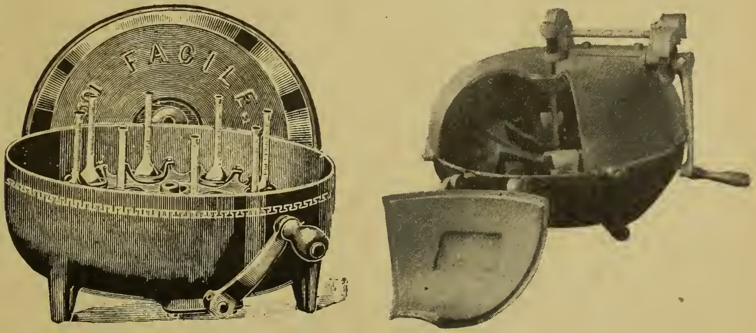

FIG. 5.—DIFFERENT STYLES OF HAND TESTERS NOW ON THE MARKET

When handling sulphuric acid wear an apron and have a supply of water ready for instantly washing acid from the clothing, person or furniture upon which it may be spilled in case of an accident. After thorough washing with water, a little household ammonia, or baking soda, or lime water may be applied and washed off with more water. **Sulphuric acid must not be measured in the pipette** because of danger of drawing it into the mouth.

Mixing the Acid and Milk

The sulphuric acid in the test bottle weighs more than the milk, and the acid goes to the bottom at once, forming a clear layer, which may become brown at the surface where it touches the milk, if left unmixed. As soon as the acid is all poured in, the test bottle should be held by the neck and immediately shaken in a circle so as to mix the acid and milk. (See Fig. 6.) Keep the liquid out of the neck of the bottle, while shaking it, to prevent loss. During the filling and mixing, point the neck of the bottle away from the face, so that no drop of acid may be thrown into the eyes.

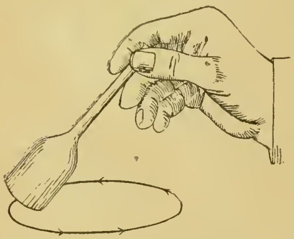

Fig 6.—To mix the acid and milk whirl the bottle in a circle until the contents are of a uniform brown color.

As the shaking is continued, the mixture turns to a uniform brown color and becomes quite hot. Be sure to mix thoroughly. Write the number of the sample with a common black lead pencil on the roughened spot on the side of the test bottle.

When there is much testing to be done, it is better to first measure all the milk samples into the bottles, labeling each and then cool them, if necessary, in cold water. Shake each bottle immediately after adding acid to it and whirl the whole set while all are hot. If the test bottles become cold after adding acid and before whirling, they should be warmed again by placing for about 10 minutes in water heated nearly to boiling. Work in a comfortably warm room.

Whirling the Bottles

Having placed the bottles opposite each other in the whirling machine (called a centrifuge), close the cover and whirl the bottles for about five minutes at the speed indicated in directions furnished with the machine. Allow it to stop gradually.

The centrifuge is generally enclosed in an iron box, so that if anything should break while the machine is running, no one would be injured by flying pieces. **The cover should always be kept closed while the machine is running.** The wheels will turn more easily and last longer, if they are oiled daily when in use. The bottles move about 40 miles per hour and travel around the circle from 700 to 1,000 times a minute depending upon the diameter of the circle. The machines are not all of the same size and some go faster than others. A weight hung by a string 22 inches long will swing back and forth about 80 times per minute, and about 70 times if the string be made 24 inches long. Such a pendulum, once adjusted to right length with the aid of a watch, is a help in running the tester at the right speed. In large factories where many samples are tested, the centrifuges are run by electric or steam power. (See Fig. 7.) In the latter case a speed indicator or a steam pressure gauge is used to run the machine at the proper speed. Running faster than directed is likely to break the bottles. Running too slow may cause the test to read too low, or be not clear.

The cover is opened when motion has stopped, and with the pipette or rubber tube a small amount of hot, soft water is added to each bottle, without taking it out of the pocket. The bottles are thus filled to the neck, and the machine is then closed and run at full speed for another minute or two. More hot water is added with the pipette, bringing the fat up into the neck, between the top and bottom of the scale of figures, and the machine is closed and run another minute or two, for the third and last time.

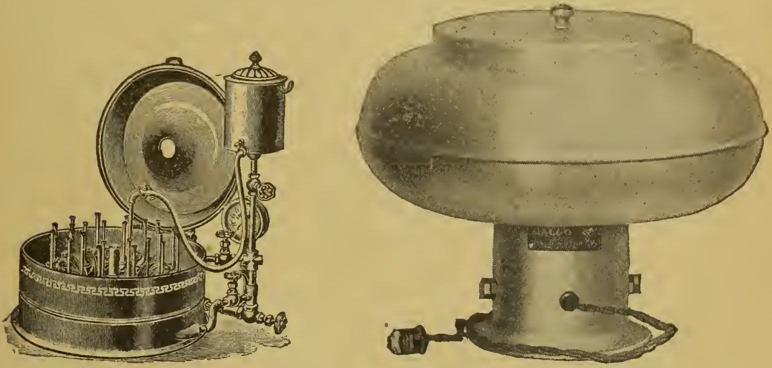

FIG. 7.—TESTERS RUN BY STEAM OR ELECTRIC POWER

Electric testers used in large creameries often have electric heaters to keep the bottles hot.

A few operators prefer to add enough water after the first whirling to bring all the fat up into the neck and whirl the bottles only two times in all. It is always desirable that the layer of fat after whirling should be clear and free from watery bubbles or solid particles before it is brought up into the neck for reading. A little extra shaking after the first addition of water will sometimes help to clear the fat.

If only two or four bottles are being tested, and the centrifuge is hot, the bottles may be taken out of the machine one at a time and the percentage of fat read from the neck of each bottle, while still hot and before the fat solidifies. It is always better, and especially when a large number of tests are being made, to place all the bottles in a tank of water at about 140° until each has been read.

Reading the Percentage of Fat

Incorrect methods of reading often account for disagreements between tests made by different parties.

In reading the percentage of fat in the neck of a milk test bottle, readings are made at the extreme top and at the bottom of the fat column. Subtracting the smaller of these figures from the larger gives the percentage of fat in the milk. By the aid of a pair of dividers, the subtraction is avoided, and the percentage of fat is read directly from the neck of the bottle.

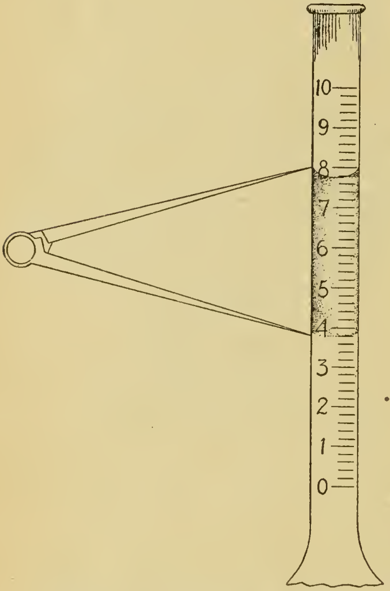

Fig. 8.—The dividers in the first position for reading the test.

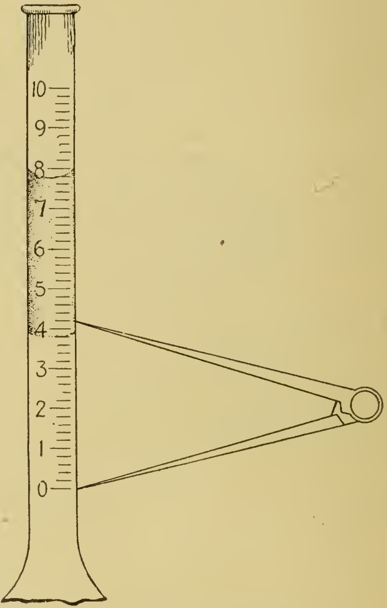

Fig. 9.—The dividers in the second position.

To use the dividers, adjust the points to the top and bottom of the fat column as shown in Figure 8; and then, without changing the distance between them, place one point at the bottom of the scale of figures, and read on the scale the position of the other point as in Fig. 9. This gives the percentage of fat in the milk.

Fat begins to soldify at about 100°. Warming the fat in the neck of a test bottle from 110° to 150° makes it expand about 1.5 per cent of its volume. This expansion amounts to about .05 per cent fat on a test reading 3.5 per cent fat, and hence may be too small to be of importance in milk testing. However, in cream testing, it is always necessary to regulate the temperature with care to get a clear fat column.

The fat column when read should be light brown and uniform in color. Hold the test bottle at the level of the eye when making a reading. Black or dark colored sediment appearing below or mixed with the fat is caused by too violent action of the acid on the milk and may interfere with correct reading. To avoid this trouble in repeating the test, the milk and acid may be cooled if either is above 60° or 70°; sometimes a little less acid may be used in the test or the acid added in several portions, shaking after each addition. Even with strong acid with a specfic gravity of 1.84, a clear test can be obtained by cooling and using only two-thirds to three-fourths of a measure full of acid.

Light colored curdy material, sometimes seen floating just below or in the fat column consists of a mixture of fat with water, or some other milk constituent which was not fully dissolved by the acid. Long continued whirling may improve such a test. Where much of this light colored curd occurs, it is likely to contain considerable amounts of fat, so that the reading of the clear fat column will be too low. The cause of this trouble may be that the acid and milk were too cold when mixed, or that they were not sufficiently shaken or whirled, or that the acid used was too weak. To avoid such trouble, the milk may be warmed to about 70° or a little more than the usual proportion of acid may be used.

Bubbles of foam at the top of the fat column are sometimes caused by the use of hard water. To avoid this use soft water for testing, or add a few drops of sulphuric acid to the water before heating it.

The beginner should practice sampling and testing milk until he is well acquainted with every step. Finally he should be able to make several tests on the same sample of milk which do not differ in reading by more than one-tenth of a per cent. A beginner should always make duplicate tests.

Cleaning the Test Bottles

Having read and recorded the per cent of fat from each test bottle, empty all of the bottles while still hot. The white sediment in the bottom is mostly removed by shaking the bottle while the hot acid is running out. Wash the bottles thoroughly, using hot water and soda, washing powder, or soap if necessary, to remove all of the fat. Small specks left sticking to the inside of the neck of the bottle can be removed by means of a brush sold for the purpose or with a bit of cloth fastened to the end of a wire. Finally rinse with clean water.

Calculating Weight of Fat in Milk

To find the pounds of fat in any quantity of milk, it is necessary, first, to weigh the milk; second, to test the milk to find the per cent of fat; and third, to multiply the weight of the milk by the per cent of fat and divide by 100.

For practice, one learning to make the test may figure the pounds of fat in:

25	pounds	of	milk	testing	5.0%	fat.	Ans.	1.25	lbs.	of	fat.
37	"	"	"	"	4.0%	"	"	....		"	
70	"	"	"	"	3.5%	"	"	....		"	
97	"	"	"	"	3.8%	"	"	....		"	
427	"	"	"	"	3.9%	"	"	....		"	
85	"	"	cream	"	32.5%	’.	‘,	....		"	

Sampling and Testing the Milk of Different Cows

Cow testing is of great importance. Any one who knows how to handle the Babcock test can successfully test the cows in the home herd. Thousands of Wisconsin dairy farmers are now testing their own cows, or have joined cow testing associations* in order to have the work done for them, at a cost of about $3 per month for the entire herd. Very few dairymen who have had their cows tested monthly for a year or more are willing to discontinue the work. For by monthly testing, the owner knows the weight of milk and of butter fat produced by each cow during the year.

This enables him at the end of the season to pick out his most profitable cows, whose calves should be kept to improve the herd, and also to know which are the poorest cows in the herd which should be replaced, because in very many cases they do not pay for their feed.

For cow testing, it is necessary to weigh and test the night and morning milk of each cow, once in each month. This is the plan followed by most cow testing associations, and it is also suitable for farmers who do their own testing. In addition to the Babcock test outfit, a milk scale is needed, preferably one that reads in pounds and tenths instead of pounds and ounces. It should weigh up to 30 or 60 pounds and can be used for weighing feed as well as milk. The scale shown in the figure can be bought for $4 to $5 or less. It should be hung in a well-lighted place, and each cow's milk should be weighed just before it is strained into the milk can. With the special milk weighing pail empty, on the hook, the movable red index can be set at zero, and afterwards the reading of this index gives the net weight of milk in the pail. The record of the weights for a month is kept on a sheet of paper which may be ruled in columns at home and tacked up on the wall, or on a swinging shelf.

Monthly or Daily Weighing of the Milk

After buying the milk scale and using it a few months many find it so little work that they prefer to weigh the milk every day for the reasons given below, although the testing is done only one day in each month. The daily weighing of milk enables the owner (1) to feed each cow in the most economical way according to her flow of milk,* and to observe how the flow of each cow is affected by changes of feed or other condition; (2) to quickly detect any sudden decrease in milk flow, which may indicate illness, and to give prompt treatment to such cases; (3) to regulate the drying-off period of cows; (4) by comparison of one day's milk flow with another, the owner can be sure that the milk used once a month for fat testing is normal in quantity; (5) daily weighing of the milk shows which milker is doing the best work. It stimulates interest in the cows, their milk yield, their care, and in the possibility of improving existing conditions, by skillful feeding, by grading up the herd and in other ways.

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* For further information about "Cow-testing Associations," obtain Bureau of Animal Industry Circular No. 179, also Circular 103, from U. S. Dept. of Agriculture, Washington, D. C.

For Experiment Station reports upon cow testing, and related topics, see Farmers Bulletins, Nos. 55, 56, 114, 162, 273, 334, 384.

"Cow Testing Pays" is the subject of Wis. Agr. Expt. Sta. Cir. 67.

If the milk is weighed daily, the total weight of each cow's milk at the end of the month is obtained by adding up the daily weights. If the milk is weighed only on one day in the month, this weight is multiplied by 30 or the actual number of days in the month to get the total weight for the month. To get the weight of butter fat produced each month, the weight of the month's milk is multiplied by the per cent of butter fat which it contains, found by sampling and testing.

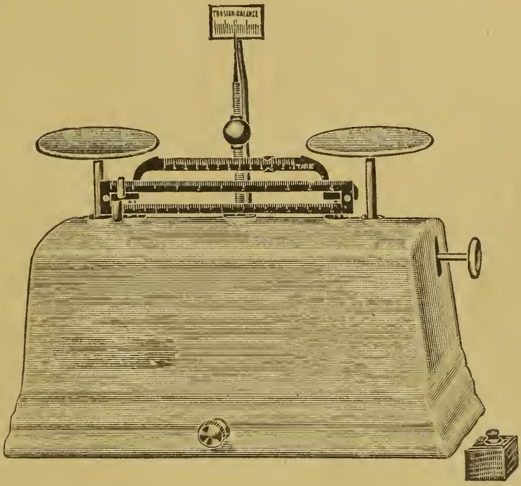

FIG. 10.—SCALES FOR WEIGHING SAMPLES OF CREAM FOR THE BABCOCK TEST SHOULD WEIGH ACCURATELY TO .05 GRAM, OR LESS.

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* The general method of feeding according to milk flow is illustrated in the following extract from Bulletin 200 of this Station: "It has been found a good working rule to feed as many pounds of grain feeds per day to each cow as she produces pounds of butter fat in a week, or one-fourth to one-third as much grain as she gives pounds of milk daily, the amount depending upon the per cent of butter fat in the milk. * * * Each cow should receive as much roughage as she will eat up clean, and a portion of this should be of a succulent nature, like grass, silage, soiling crops or roots."

Sampling Milk at the Barn for the Fat Test

This may be managed in various ways with greater or less accuracy, according to the facilities at hand, and the choice of the owner. A good way is as follows: The fat testing should be done as nearly as possible on the same day of each month.

A small tin sampling dipper or a large spoon, holding about one-tenth of a pound, and a set of 4-ounce sample bottles (one bottle for each cow) with corks and labels, will be needed. A small box or frame, with partitions to prevent the bottles from tipping over, is a convenience. On the day selected for fat testing, the set of sample bottles and the sampling dipper are carried to the barn. The pail of milk from each cow is weighed as usual, and is then stirred well. While the milk is yet in motion, a dipper full is transferred from the pail to the sample bottle, which is then labeled with the cow's name or number, and closed tightly, to avoid evaporation.

Samples of milk should not be pipetted directly from the milking pail into a Babcock milk test bottle as they are apt to contain foam or air bubbles, and give too low tests.

Since night and morning milk are apt to test differently, it is desirable that at the next milking, a second sample of each cow's milk be transferred in the same manner to her sample bottle. The bottle is then shaken with a rotary motion to completely wash down and mix in any cream that may have risen or stuck to the sides of the bottle. A 17.6 cc. pipetteful of the well mixed samples is transferred to a Babcock test bottle, and the tests are finished in the usual manner. If a test should be lost, another portion from the same bottle can be tested. In this way, only one Babcock test bottle is used for each cow, and the reading of the test represents the average per cent of fat in that cow's milk for the month. Some prefer to run two test bottles on each cow's milk, thus securing greater accuracy.

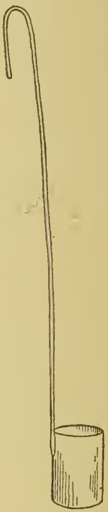

Fig. 11—Sampling Dipper

No preservative need be used if the bottles are cooled in cold water and kept in a cool place, so that samples of the first and second milkings can be mixed and a pipetteful transferred to the Babcock test bottle before the milk has soured and thickened. If the samples thicken in the test bottles before adding sulphuric acid, this does not interfere with getting correct fat tests.

Other Methods Sometimes Used

While the methods described above are sufficiently accurate for ordinary use, owners of exceptionally fine cows or those who have more time in which to do the testing may prefer to test more than one day's milk each month. For this purpose, preservative tablets are used, and the milk samples are added to the sample bottles for as many consecutive milkings as desired, usually covering two days, and in some cases three or four days. Since different milkings from the same cow vary in weight as well as in fat content, the method of collecting samples described above may be improved by purchasing and using a sampling tube instead of a sampling dipper. Where the sampling tube is used, the milk must be poured into a can or pail having "straight-up", not flaring sides, and the sampling tube is then inserted to the bottom of the can. In this way, the volume of the sample taken from each milking is greater or smaller, in exact proportion to the amount of milk obtained from the cow. These and other precautions may be observed when a cow is being tested for the purpose of establishing a record. But when a herd is being tested by the owner to pick out the poorest cows, in order that these may be sold and the herd improved, any method described will be sufficiently accurate.

Testing Skimmilk by the Babcock Test

Whenever cream is sold, the skimmilk should be tested occasionally to make sure that the cream separation is reasonably complete.

To test skimmilk, (1) catch a drip sample of the entire run of skimmilk and mix well, or collect the entire quantity of skimmilk running from the separator in a tub or barrel and mix it well by stirring; (2) while the skimmilk is still in motion, measure with a pipette 17.6 cc. of milk, avoiding the foam, into a special form of Babcock test bottle called a skimmilk bottle; (3) cool the milk to 60 degrees or lower, and (4) add about 20 cc. of acid and whirl at full speed longer than usual, and keep the bottles hot, since it is hard to get out all the fat in testing skimmilk.

The ordinary milk test bottle reading 10 per cent on the scale cannot be used for testing skimmilk, because the column of fat from skimmilk generally fills less than one division on the scale and therefore cannot be read. The skimmilk test bottles have a double neck, with a wide tube for pouring in the milk and acid and a narrow tube in which the fat column rises. The scale is graduated to one-fourth or one-half of one per cent, in 1/100 divisions.

These bottles are also used for testing buttermilk and whey. Warm whey fresh from the cheese vat must be cooled before adding acid. For this purpose set the test bottle containing the 17.6 cc. of whey in a pan of cold water for a time. About three-fourths of a cylinder full of sulphuric acid should be added in three or four portions to each test bottle of whey. The test is then completed in the usual way.

Testing Cream on the Farm

Cream testing is more difficult than testing of milk or skimmilk, because in putting exactly 18 grams of cream into the test bottle, the cream cannot be measured with a pipette but must be weighed. There are three principal reasons for this. First, a pipette holding 18 grams of milk will hold 16 to 17 grams of cream, depending upon the richness. Second, much of the cream will stick to the inside of the pipette, which would make the test read entirely too low. Third, fresh separator cream contains many air bubbles.

Cream scales, accurate to .05 gram, and one or two nine gram weights are needed for weighing cream samples into the test bottle. Several forms of scales are sold for this purpose. (See Fig. 10.) Anyone intending to purchase cream testing scales or glassware for use in selling or buying cream in Wisconsin should see that these are marked "sealed" as conforming to rules laid down by the State Superintendent of Weights and Measures, State Capitol, Madison.

Sometimes, 9 grams of cream are weighed into an 18 gram bottle, and the fat test reading multiplied by 2 to get the cream fat test, but the present Wisconsin law has been interpreted to require that 18 grams of cream must always be weighed into one bottle where cream is bought or sold.

Since cream may contain 20 to 45 per cent fat, special cream test bottles, holding 18 grams of cream and reading up to 30, 40 or 50 per cent on the scale are used. (See Fig. 13.)

Two cream test bottles are placed on opposite pans of the cream scales and the sliding weight is moved until the two sides are exactly balanced. Two nine gram weights or one 18 gram weight is then added to the right hand pan. The cream is thoroughly mixed by vigorously stirring, which must be continued longer than for sampling milk because cream is thicker and harder to mix. While the cream is still in motion, some of it is taken up in the pipette, and allowed to flow into the cream bottle on the left hand pan of the scales without spilling, rapidly at first, and later by drops, until the scales are again exactly balanced. The bottle now contains exactly 18 grams of cream.

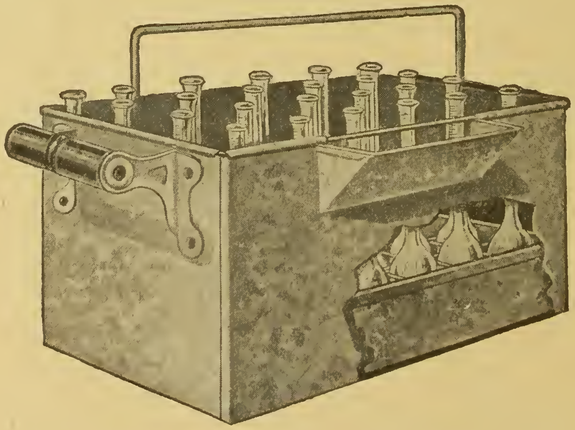

FIG. 12.—TEST BOTTLES IN A TANK OF HOT WATER

The weights are then taken off and the second test bottle is filled until the scales are again balanced, from another pipette full of cream, taken after stirring again. After mixing the acid and cream, the bottles are placed in the tester and whirled as usual.

The percentage of fat in cream is read from the bottom of the fat column to the bottom of the upper meniscus. The test when read should be held at the level of the eye, which can be done more exactly with the aid of a mirror. Some special reading devices are also on the market.

Reading Cream Tests

It is somewhat difficult to see the bottom of the curve or meniscus at the top of the fat column in a cream test bottle. The meniscus can be flattened, and the reading made easier and more accurate by placing on the top of the fat column, just before reading, a few drops of glymol, amyl alcohol, or "red reader." The reading is best made immediately after the addition, before the bottles are shaken.

The fat should be at about 120° F. when the cream test reading is made and the bottles should always be set in hot water at this

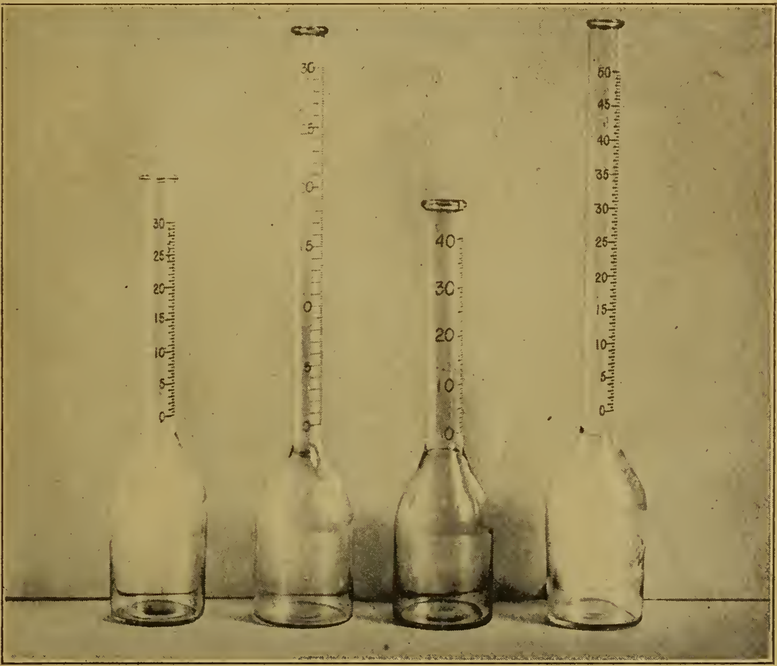

FIG. 13.—TYPE OF CREAM BOTTLE WHICH IS WIDELY USED.

The smallest graduation should be 0.5 per cent. The 6-inch bottles are most common, as the 9 inch sizes require a larger centrifuge.

temperature for 15 minutes before making the final reading. The results of two tests on the same lot of cream should not differ more than .5 per cent.

If brown or black specks appear in the fat column so as to prevent correct reading, the action of the sulphuric acid was too violent. To prevent this see that neither the cream nor acid is too warm and either use a little less acid, or else as soon as the acid and cream have turned to the proper brown color in the test bottle, add hot water, up to the bottom of the neck, to dilute the acid and check its further action.

Sealed Scales and Glass Ware

In Wisconsin, the State Superintendent of Weights and Measures, at Madison, Wis., is authorized to test the accuracy of cream scales, milk pipettes, and Babcock test bottles for milk and cream, which are used in the state. Only those test bottles, and scales, which meet the state requirements as to mode of construction, and which bear the mark "sealed," showing their accuracy, can be lawfully used, in Wisconsin, in the testing of milk or cream for sale. Wisconsin dairymen and milk dealers should avail themselves of this opportunity to have their bottles calibrated free of charge, and when purchasing new test equipment should specify that they shall pass the inspection of the state authorities. Factory patrons should insist on the use of "sealed" bottles, in order to avoid errors in payments, through use of incorrect glass ware.

Testing Rich Cream

A very large proporton of creameries have 30 per cent six-inch cream test bottles and a centrifuge holding only this size of bottle. When cream is richer than 30 per cent, it is impossible to make the test in such bottles, using 18 grams of cream as required by Wisconsin law (in 1924). Instead, the creamery might buy a new 9-inch bottle centrifuge and a set of 9-inch bottles reading up to 50 per cent fat. In other states the law permits the creamerymen to weigh 9 or 10 grams of cream instead of 18 into the 6-inch 30 per cent bottles and make a calculation of the fat test from the reading, which appears to be the simplest satisfactory solution of the difficulty.

Testing Cheese for Fat

Weigh 9 or 10 grams of cheese into a 30 per cent cream test bottle, in the manner described for weighing cream. Fill the 17.5 cc. measure with acid ready for use. With a wide tipped pipette, add 10 cc. of boiling water to the cheese in the bottle, and immediately begin adding the acid, as rapidly as possible, in small portions at first. Shake once after each addition to mix the acid and water. When half to two-thirds of the acid is in, the rest may be added at once. The high temperature caused by mixing the acid with boiling water quickly melts and dissolves the cheese, leaving the fat clear. The addition of small portions of acid at first prevents loss. The test is whirled and finished like any cream test.

If the first sample tested appears to dissolve slowly in the hot mixture of water and acid, the next test may be hastened somewhat by dipping the test bottle in boiling water a few seconds before adding water to it.

How Composite Samples Are Made

Cream samples should be tested daily. At cheese factories, there is not time to test patron's milk every day. But if the milk were sampled and tested only one or two days each month, it might happen on those days to be richer or poorer in fat than usual. To avoid such difficulty, factorymen generally provide a set of composite sample bottles, each marked with a patron's number and provided with a tight fitting stopper to prevent evaporaton of contents. Every day a small portion of milk is taken from the weigh can with a sampling tube and placed in each patron's bottle and the cream is shaken down, with a rotary motion, from the sides of the bottle. The samples are kept from curdling by the addition of a small preservative tablet to each bottle, and each sample is tested at the end of two weeks. A set of numbered sample bottles holding composite samples can be seen near the intake of almost every creamery and cheese factory in Wisconsin.

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Circular 173

June, 1924

Sewerage Systems For Farm Homes ~

EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN, IN COOPERATION WITH
THE WISCONSIN STATE BOARD OF HEALTH MADISON

ONE OF THE ADVANTAGES of country life is the abundance of out-door air, pure water, and sunshine, but too often these advantages are offset by impure water supply and unsafe sewage disposal.

Good sanitation is within the reach of every farmer. It is neither convenient nor economical to get along without it.

Every farmer owes it to himself to follow simple rules of health on his own farm and to stimulate the interest of the community in sanitation. He does this by draining stagnant pools and requiring dairy and canning factories to dispose of their waste without offending the public. He sees to it that the school house is well lighted, heated and ventilated and provided with good water, a dry, safe play ground, and ample sanitary toilets. He takes an active part in the prevention of stream pollution.

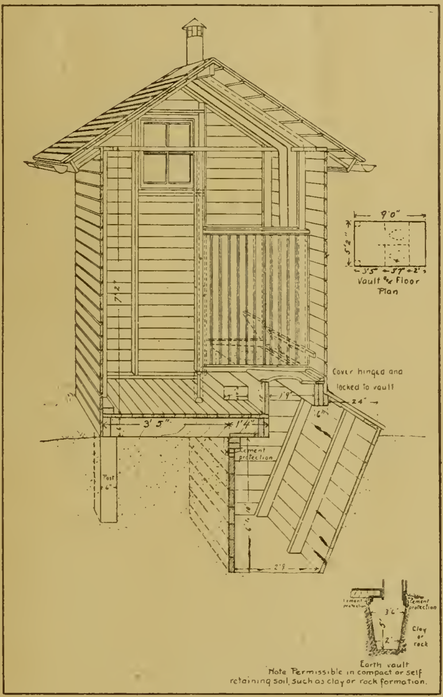
Sewerage Systems for Farm Homes

N. S. Fish, E. G. Hastings and Frank R. King[1]

SEWERAGE systems and running water are modern conveniences which often can be installed in the farm home at no greater cost than in the city.

Public water mains furnish the water in the city and the public sewer removes the wastes from homes, schools, and factories. In the country there is no such public service. Private water systems and private sewage disposal plants are necessary.

The water supply system may require expert service in installation and maintenance. Unfortunately some of the manufacturers do not supply such service.



Note Permissible in compact or self retaining soil, such as clay or rock formation.

FIG. 1—OUTDOOR TOILETS CAN BE SANITARY

Make the vault vermin and fly-proof. Provide adequate light and a vault ventilator. When near a shallow well make the vault water-tight. Have an outside door for cleaning it.

The sewage disposal plant is usually simple and can be made by ordinary workmen following well established rules.

Select the right plan for the right place. A sewage disposal plan that may work well under one set of conditions may be useless under others. The proper plan depends on the slope of the land, the type of soil, the natural outlet and the amount of waste.

Improving the Outdoor Toilet

At best the outdoor toilet will be far from perfect. Poorly constructed or improperly located, it is a constant source of disease. Until it is replaced by a modern toilet, keep it as sanitary as possible.

The shelter house and vault or other container should be fly-tight. Unslaked or water slaked lime placed in the vault deodorizes the contents. A hinged cover on the outside as shown in Figure 1 makes it easier to clean the vault. Keep the toilet and its surroundings clean. Keep the vault dark and ventilated by a pipe going up through the roof. Also ventilate the shelter house and keep it well lighted.

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[1] Wis. State Plumbing and Domestic Sanitary Engineer.

Treating the Sewage

Septic Tanks Break the Solids. A septic tank is one in which solid waste carried in water is broken up by the action of bacteria working without air. Such a tank makes it possible to have the toilet in the house. The sewage is carried by water to the septic tank outside. (Fig. 2). Because they retard bacterial action, chemicals must not be allowed to enter the tank.

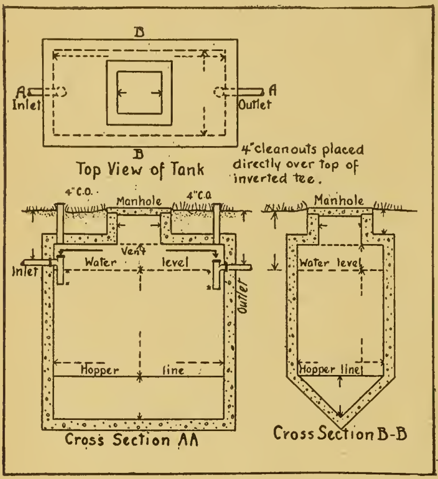


FIG. 2.—THE SEPTIC TANK SIMPLIFIED

Such a tank (Type B) may be used with any kind of a disposal system. The walls are 6 inches thick. The dimensions depend on the size of the family. The capped pipes set in the cover above the tees permit the use of a stick to break a clog that may form. Movable concrete slabs may be used for the cover.

As the bacteria break up the solid material some of it escapes as gas. Some is carried away by the water through the outlet. A small portion settles to the bottom forming a sludge. The gases find their outlet through the ventilator which is the soil pipe that extends through the roof of the house. The water called the "effluent", escaping from the outlet, is cared for by a disposal system described in later pages. The sludge must be cleaned out as occasion demands. The hopper bottom makes cleaning simpler, but it is somewhat easier to make a flat bottom.

Where to Put the Septic Tank. The tank should not be nearer the house than 2 feet. It needs to be covered with enough earth to protect its contents from freezing; generally 2 feet of covering is sufficient. Where the slope below it is small it may be necessary to have the top of the tank level with the top of the ground. In that case a covering of moist straw one foot deep is placed over the tank for frost protection about November 1 each year. It is economical to have the plumbing in the house so planned as to discharge its waste conveniently into a septic tank on the favorable, usually the downhill side of the house.

How Large Shall the Tank Be. A tank 2½ feet wide, 5 feet long and 5 feet deep below the outlet pipe is the smallest advisable. This will serve six persons or less. Twelve persons require a tank 3 feet wide and 6 feet long. For greater requirements add 4 cubic feet of working capacity for each person, and two cubic feet for every 20 gallons of laundry water entering it daily.

About 30 gallons of water for toilet flushing are required for each person each 24 hours. The tank should be large enough to hold twice the amount of water used by the family so that the sewage may remain in the tank approximately 48 hours. The flow toward the outlet should be the long way through the tank.

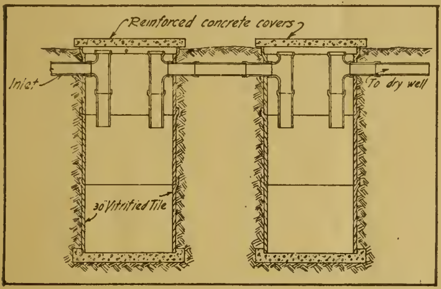


FIG. 3.—VITRIFIED PIPES SAVE FORMS

They may cost less than a concrete tank. One unit will serve only a small family, but additional units may be added. When the inlet drain is 2 or more feet below the ground, 4 or more lengths of tile per unit are required to obtain the necessary depth below the outlet and to bring the manhole to the surface. Care must be exercised in locating and cutting holes and joints and bottom made water-tight.

A sanitary tee open at the top at both outlet and inlet of the tank permits a free circulation of air. Both outlet and inlet extend down below the scum that forms on the surface. The inverted outlet removes the effluent from the place where it is clearest. Baffle boards may be used to control the flow through the tank, but are more expensive than the tees.

Trap the Kitchen Grease. Grease from the kitchen waste should be kept out of the septic tank where it is likely to harden and clog. A grease trap is recommended. This consists of a basin in which the grease hardens in a scum on the surface and can be removed easily about once a year. (See Fig. 4.)

By-Passing Clear Water. Dairy houses and home laundries have large quantities of liquid waste, best disposed of by a separate drain without entering the septic tank at all. Such waste together with rain water from roof, cistern overflows, and outdoor surface water receive no treatment in the tank and merely tend to overwork it. Another reason for not passing laundry water into the tank is that the soap may interfere with the action of the tank.

Ventilation Essential. Free air circulation means air entering through inlets. It passes freely from one disposal unit or tank to another. Then it enters the open top of the tee at the inlet of the septic tank and rises through the house drain, soil, waste and vent pipes to a point above the house. This carries the odors and gases to a point above the roof. The traps in the plumbing, if properly protected against syphonic action, prevent any odor entering the house.

Disposing of the Effluent

Why Cess Pools Fail. A cess pool is a hole in the ground with cribbed sides and open bottom into which the sewage is discharged. Disposal depends upon seepage into the ground. In tight soils this is slow. In coarse gravel it becomes slow as the pores fill up. Finally absorption ceases altogether and a new hole must be dug.

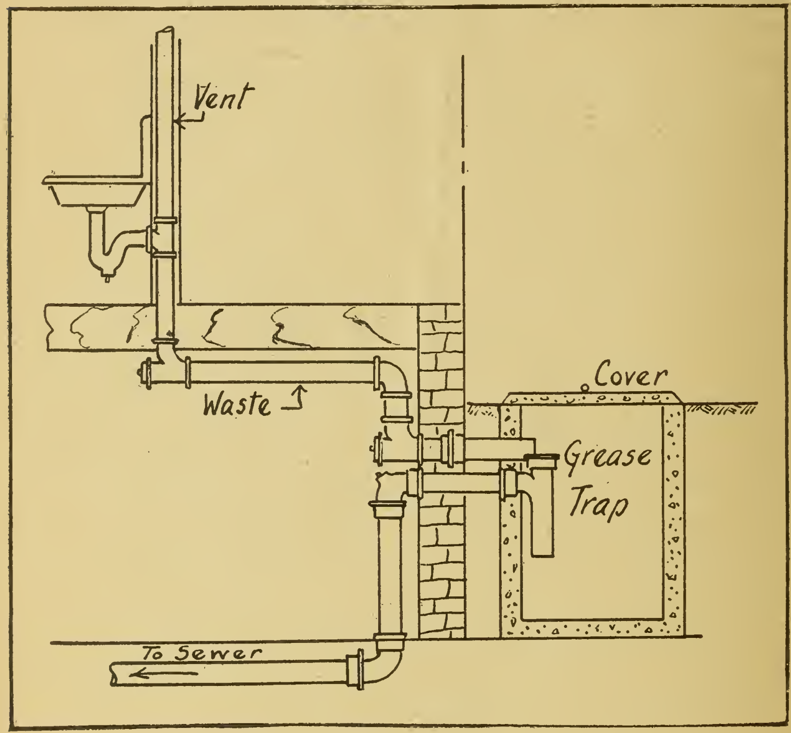


FIG. 4.—TRAPPING THE KITCHEN GREASE

The grease hardens and rises to the top of the water contained in this basin. This keeps it out of the septic tank. The clear water passes out through the turned down outlet drain and is then piped to the septic tank.

The cess pool is more dangerous than an open-bottom, outdoor toilet vault because of the large amount of water that increases percolation and pollution in the soil. The state plumbing code now prohibits the cess pool.

Unlike the cess pool, the septic tank is water-tight and has an inverted pipe 5 feet above the bottom for its only outlet.

A Dry Well to Receive the Effluent. In 75% of the locations in the country and small towns the dry well is the only practical means of disposal. The effluent seeps from the dry well into the soil. Safety requires that the dry well be at least 50 feet from a dwelling or cistern and at least 150 feet away from a surface well or spring. Without contaminating the water supply the dry well may be within 50 feet of a drilled well where the casing extends 100 feet below the surface of the ground and is driven firmly into rock. An abandoned water supply well is not permissible as a leaching compartment for sewage disposal because it is too deep for safety. A sandy or gravelly soil is safer than a clay soil full of seams or porous, creviced rock.

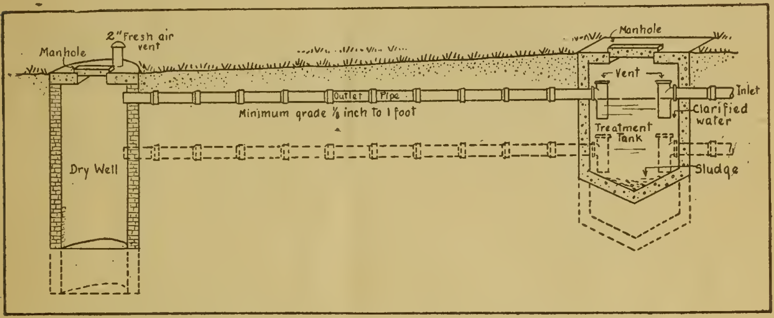


FIG. 5.—DRY WELL WITHOUT DRAIN OR FILTER

This is the most common means of disposal. (Type C). For better frost protection or to reach deeper porous ground or gravel or where the house drain leaves the building at some depth, it may be made deeper as shown by the dotted line.

A dry well may be used in three different ways. It may have percolation from its sides and bottom as its only outlet (Fig. 5). This is better than a cess pool, because the sewage is treated before it enters. This well also lasts longer than the cess pool and is more sanitary.

The second type (Fig. 6) provides for filtration of the sewage between the septic tank and the dry well. There is air in the gravel filter that helps to break up the sewage further. Part of the effluent is thus disposed of by absorption near the surface of the ground. This

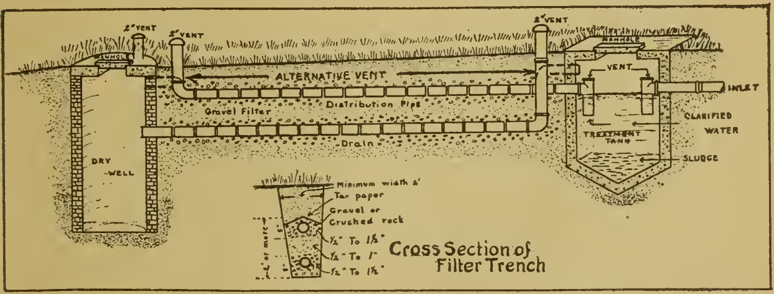


FIG. 6.—FILTERED BEFORE ENTERING THE DRY WELL

Air-loving bacteria help to liquefy the sewage before it enters the dry well (Type C5). See pages 12 and 13 for laying tile.

type is advisable where property lines or the slope of the land limits the absorption area.

The third type (Fig. 7) is similar to the second except that the sewage is filtered after it leaves the dry well but before it enters a lake, stream or ditch and is limited to locations near such waters.

In tight soils, two dry wells, each used at intervals, are better than one.

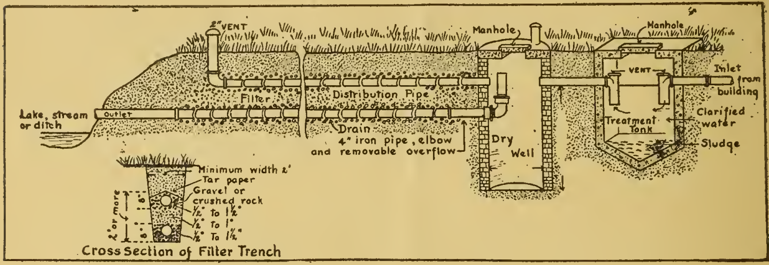


FIG. 7.—FILTERING THE FLOW FROM THE DRY WELL

The drain makes the dry well last forever. As the filter's efficiency decreases the filter material must be replaced. This system does not wholly prevent stream pollution (Type C6): May discharge into a dry run.

Septic Tanks and Dry Wells Cost Little. A septic tank 3 feet x 6 feet and 5 feet deep below the outlet and with a cover 1 foot above the outlet contains nearly 4 cubic yards of concrete with a 6-inch wall. The dry well is usually curbed with loose rock but a reinforced concrete top is necessary. The tank and dry well together require about 6 barrels of cement, 2 cubic yards of sand and 4 cubic yards of coarse aggregate with a 1-2-4 mix. The cost of this material and the vitrified pipe depends upon local conditions. Old fence wire may be used for reinforcing and on most farms labor is available when other farm work is not pressing.

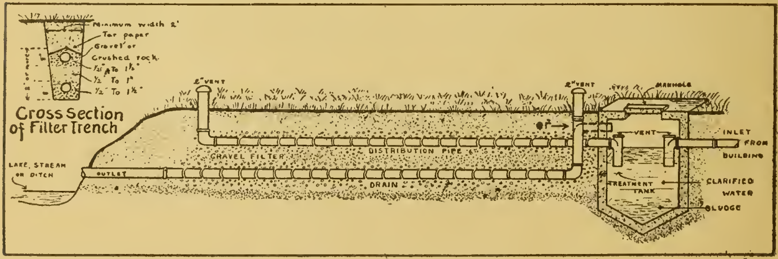


FIG. 8.—FILTERED ONCE BEFORE ENTERING THE STREAM

There is no offensive odor at the outlet into the stream, but there may be some disease germs (Type C8).

Removable concrete slabs may be used for the tops of both tank and dry well. In that case a man hole is not necessary but the vent in the dry well must be kept open at all times.

Surface Disposal Sometimes Sufficient. A limited amount of effluent treated by tank or by tank and filter may be discharged upon the surface of the ground under certain conditions. Swamp land, or a sandy slope located a safe distance from a house or road, preferably fenced against livestock, is a permissible outlet .

Where Streams May Serve. Wisconsin is well provided with ravines and rivers that may be used with certain restrictions. The sewage should be unusually well treated and due consideration given to people living below the outlet, stock watering places and fish life. The larger the river, the less objection there is to small amounts of sewage. In any case the permission of the State Board of Health is necessary before sewage of any kind, either untreated or treated, can be discharged into a lake or stream.

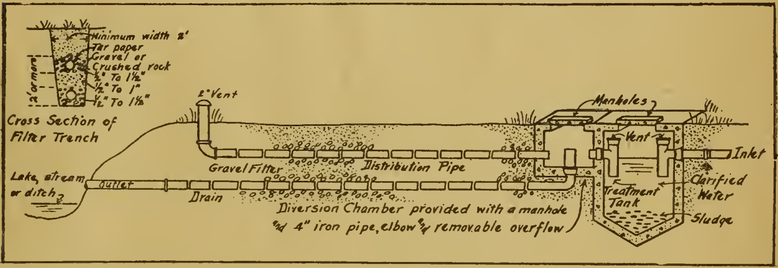


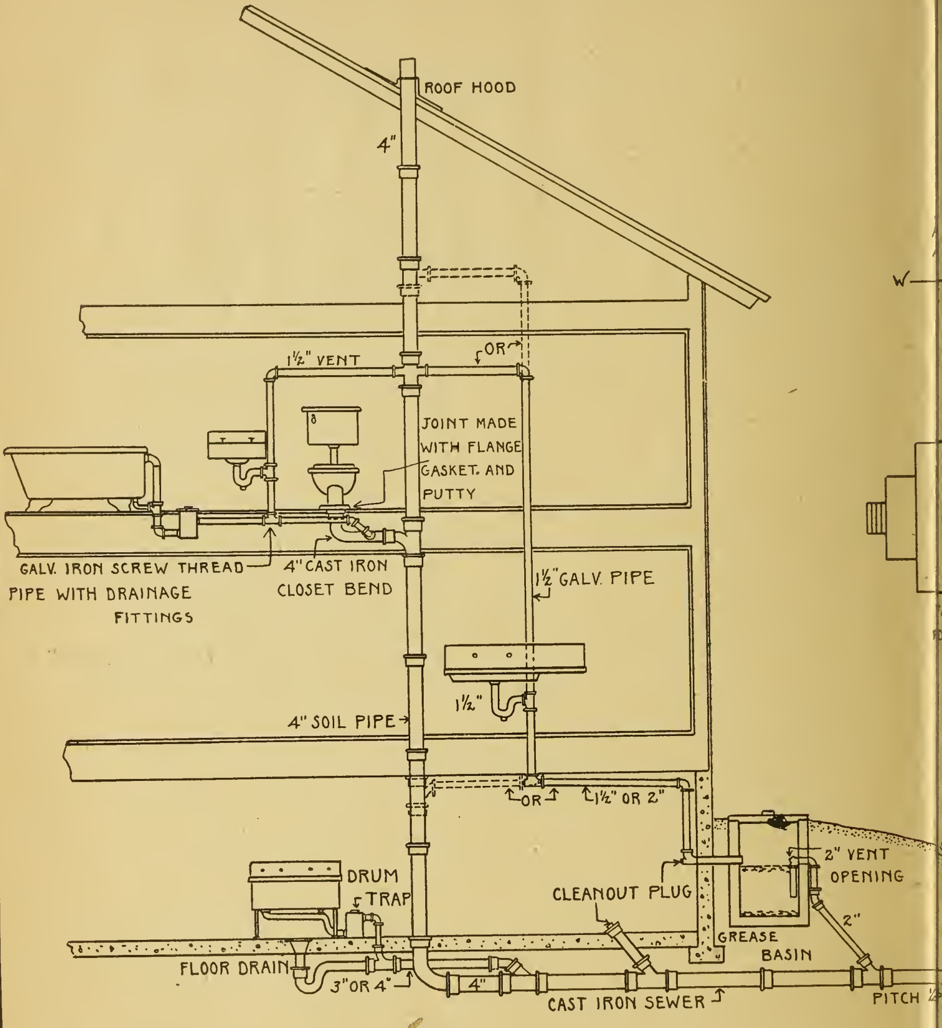
FIG. 9.—DIVERSION CHAMBER SERVES SEVERAL FILTERS

Two or more filters extending at the same level from this box are better than one (Type C9). They may all join at a common outlet into a stream, or a guarded ravine providing objectionable conditions do not result therefrom.

Tile to Spread the Effluent. An absorption field on the slope below the septic tank can be made more effective by the use of drain tile. Several lines of tile are better than one. A main of 6-inch tile leading from the outlet of the tank and with laterals of 4-inch tile about 10 feet apart spreads the water, hastens percolation, and brings it in contact with more air.

Another arrangement of the lines resembles a wagon wheel (Fig. 10). The treated sewage is delivered at the hub of the system and from there spreads out into the several lines. In any case the object of the tile is to bring the effluent in contact with the largest possible amount of soil and air.

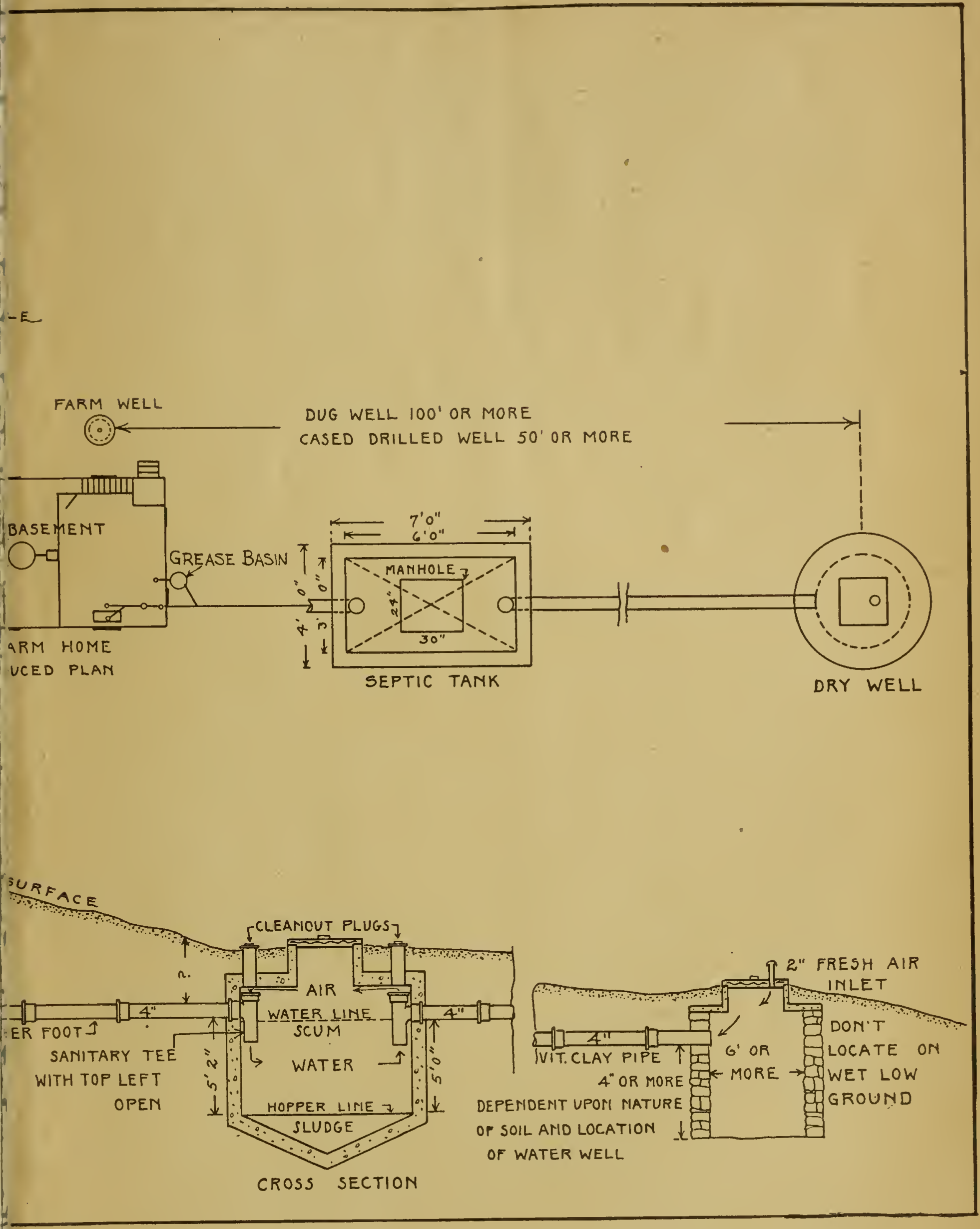
Where the flow from the tank is steady and small the soil is apt to become saturated near the hub or main while the outer ends of the lines are dry. Fortunately on most farms there are three periods of about an hour at morning, noon and night when the discharge is sufficient to reach the far end of the tile line. During the rest of the



FARM HOME SEWAGE DISPOSAL

MAKING THE F

With plenty of slope the septic tank may be farther away from th
trap before it enters the septic tank.



M HOME COMFORTABLE

ouse. It is desirable to have the waste from the kitchen go through the grease

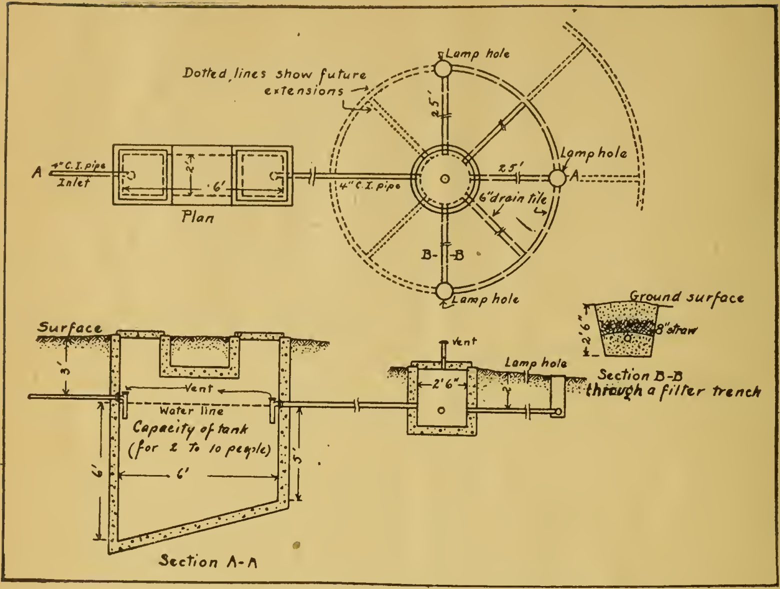


FIG. 10.—TILED LIKE A WAGON WHEEL

The sewage effluent enters at the hub and escapes through several lines of tile laid at the same level (Type C4). A dosing chamber is desirable to force equal distribution.

time there is little or no discharge from the tank. This intermittent discharge from the tank keeps all parts of the absorption system working and avoids overworking any part of it. If the soil near the main remains saturated it does not contain air enough to complete the decomposition of the effluent, and the odor may become disagreeable.

Siphon Chamber for Intermittent Discharge. An intermittent discharge into the drains is assured by the use of a siphon. This requires a siphon chamber attached to the septic tank. A gallon of water leaves the septic tank every time a gallon of sewage enters at the inlet. The discharge collects in the siphon chamber until the siphon begins to act. Then it discharges with a rush that forces the water to the farthermost part of the absorption system. A siphon chamber 3 feet square and with 17 inches of drawing depth is sufficient for a plant serving from four to ten persons.

The lines of tile in the absorption system should be long enough to hold not less than one complete discharge from the siphon chamber. This requires about 50 feet of 4-inch tile for each person served. More than this is better in tight soils.

The depth of the tile in the absorption system may be from 1 to 2 feet. Air vents are necessary for the deeper lines. A fall of 2

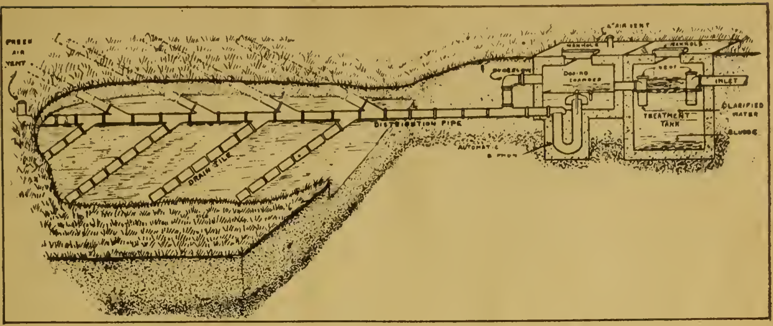


FIG. 11—TILED LIKE A HERRING BONE

Here also a dosing chamber is necessary to flush the system (Type C10). The main is the only line that needs an air vent if the tile are less than 20 inches deep.

inches in 100 feet is sufficient. Joints ¼ inch wide and a bed of coarse gravel hasten the absorption. Burlap, tar paper pads, or broken tile placed over the top of the joints protect them from the entrance of soil.

There must be enough fall from the siphon chamber to the main drainage tile to insure proper siphonic action. In many places there is not enough slope in the land to make this possible without putting the tile too deep to be effective. There, a dry well is the only alternative.

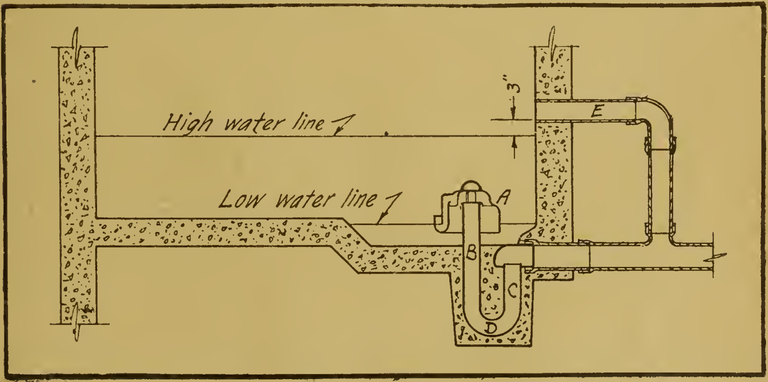


FIG. 12.—THE SIPHON IS SIMPLE

It fills up to the high water line before the siphon begins to work. Then it discharges down to the low water line. The siphon must be placed in accordance with the instructions of the manufacturer.

An overflow pipe from the dosing chamber is recommended. This permits the water to escape in case the siphon becomes clogged and lets the air circulate freely through both chambers.

Removing the Sludge. When the sludge occupies one-fourth of the septic tank it is time to pump it out. When the scum is more than 8 inches thick it is time to break it up and remove it with the sludge. The best place for it is in a field where it can be plowed under.

The tank may contain poisonous gas. Only after the lantern test has been applied is it safe for a person to enter the tank, and then he should tie a rope around his body.

Gases from volatile oils like gasoline are explosive. It is safe to lower the lantern into the tank only when attached to the end of a long rope and when no one is standing near the manhole.

Pipes and Piping

Wells Curbed for Safety. Water tight casing down into rock or deep water is the only thing that will keep the water in a drilled well safe. There are so many sources of pollution that the chances of impure water are great. They are greatest in dug wells and shallow driven wells. Privy vaults of the leaching type or sewage effluent from a septic tank may spread disease germs for 150 feet or more through a seamy soil or creviced rock sloping toward the well. Figure 14 shows the details of protecting the well and spring from pollution.

Inlet Pipes Water Tight. Cast iron pipe with leaded joints or sewer pipe with bell ends and cemented joints are used to carry the sewage to the septic tank and the effluent to the dry well. The cast iron pipe is more expensive but necessary inside of the house and outside when near the source of water supply. There should be no leakage until the effluent has reached the absorption system some distance away from the house. If a dosing chamber is used it should be as water tight as the treatment chamber.

The Pipes May Freeze. If the water in the septic tank freezes, ice forms in the submerged inlet and outlet pipes. This clogs the system. It is apt to happen when the house is left vacant for a few days in winter. The inlet pipe is given a liberal fall, preferably 1 inch in 4 feet. This makes the water in it run fast enough that it is less apt to freeze. Furthermore the water coming from the house is warm. Nevertheless it is sometimes necessary to cover the ground above the inlet pipe with straw for frost protection. Where the pipe is shallow, it is best to have the septic tank near the house for that reason.

The tile in the absorption field, whether shallow or deep, must be in a soil that will absorb water. The faster a soil absorbs water, the less danger there is of freezing. Tile laid in a sandy or loamy soil operate all winter without freezing if a reasonable amount of hot water is used and the system is not left idle for several days at a time. In clay they may freeze and become useless, unless the absorption field is covered with straw. This may be expensive.

The water supply pipes are nearly all in the house. It is usually necessary to heat the basement to keep these pipes from freezing.

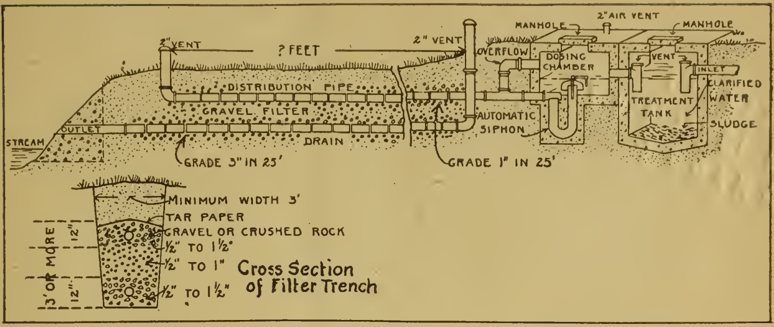


FIG. 13.—DOSING CHAMBER WITH SIPHON ASSURES INTERMITTENT DISCHARGE

This forces the effluent discharge to the farthest end of the distribution pipe and makes every part of the filter work, (Type C11).

All pipes must have a slope to permit drainage, be a safe distance from outside walls and properly protected from drafts between floors. Piping once frozen is weakened and sooner or later will leak.

Pipes and Capacities Standardized. The size of the supply pipes depends chiefly upon their length. The required capacity of the water supply system is determined by the number of persons served. Where he has to use a hand pump in the kitchen each person uses about 8 gallons of water a day for domestic purposes. If there is a cold water faucet at the kitchen sink he may use 15 gallons. The amount is increased to 25 gallons where hot water, bathroom and laundry facilities are added. To this must be added the water used each day for toilet flushing by each person. Thus the average consumption per person will be from 30 to 40 gallons per day. Lawn sprinkling, leakage, dairy uses and stock watering are extra. Horses, mules and cows require about 12 gallons of water a day in ordinary weather and sheep and hogs 2 gallons each.

For the house supply, a three-quarter inch pipe is used for the cold water riser to the bath room, and from the pressure tank if within 100 feet. For longer distances a larger pipe to the pressure tank is necessary. Half-inch pipe is sufficient for the branches to the boiler, bath, basin and closet tank.

A valve on the main line is necessary to shut off the water for repairs, but unnecessary fittings are to be avoided. Reaming the inside of the pipe ends, cutting deep, sharp threads of sufficient lengths, painting only the male thread, and securing the pipes well to the walls and testing under 80 pounds of pressure are essential features.

Salesmen for reputable water systems investigate fully the kind of water to be used and the amount necessary and sell only such systems as can be guaranteed absolutely. A further guarantee insuring good mechanical installation and prompt repair service is essential, bearing in mind that the written guarantee of a firm that lacks good faith is worthless. Only those firms that have a well established reputation for extending service with all of their sales are to be depended upon.

Waste Pipes Well Laid. Give all drain pipes a slope of **one** inch in **four** feet. Use Y's and long radius tees and bends for all changes in direction. Place an approved cleanout plug at a point above the basement floor where the sewer enters the building and at other points where stoppage is apt to occur. Stoppage within the building may be caused by poorly made joints, improper connections, sharp bends, insufficient flushing, grease, matches, hairpins and other indifferent usages. Outside of the building, tree roots may stop the sewer if the joints are not tight.

A 2-inch cast iron or 1½-inch galvanized iron pipe with screw threads is standard drain for the bath tub, wash basin, laundry tray, and sink. Small fixture traps are connected to the drain by a screw thread, making brass soldering bushings necessary for nickle plated traps. Re-vent pipes of 1½ inch galvanized iron to prevent siphonage are necessary in complicated systems. By careful measurement the openings into the drain can be correctly located so that the fixture will not have to be bent when connected.

A 4-inch cast iron pipe with an approved bend is necessary for the closet bowl. It is made water-tight by an approved flange and gasket. Firm anchor bolts are essential. The soil pipe serving the bath room must extend at full size through the roof and end 12 feet or more away from any window or air intake.

It is important that all plumbing fixtures and work be of good quality, and in accordance with the state plumbing code.

Careful Concrete Construction

Forms. The earth bank may be used for the outside form of the concrete work. Inch boards are sufficient for the inside forms. Contractors are using metal forms that can be knocked down easily.

If a siphon chamber is used it should be so protected by banking or covering that frost does not penetrate beneath it.

Mixing the Concrete. One part of cement to five of good pit-run gravel is a good mix. Or, four parts of crushed rock and two of sand may be used with one of cement. A concrete mixer is preferred because it insures thorough mixing, so essential to a wall that is to be water tight. Pour the entire wall and floor the same day to secure a good bond. Reinforcement with old fence wire or any other iron available is necessary for the top and bottom and advisable for the sides, particularly the corners.

As soon as the concrete is sufficiently hard, remove the forms and trowel the inside to a smooth finish with a coat of plaster ½ inch thick, made of one part cement and one part sand.

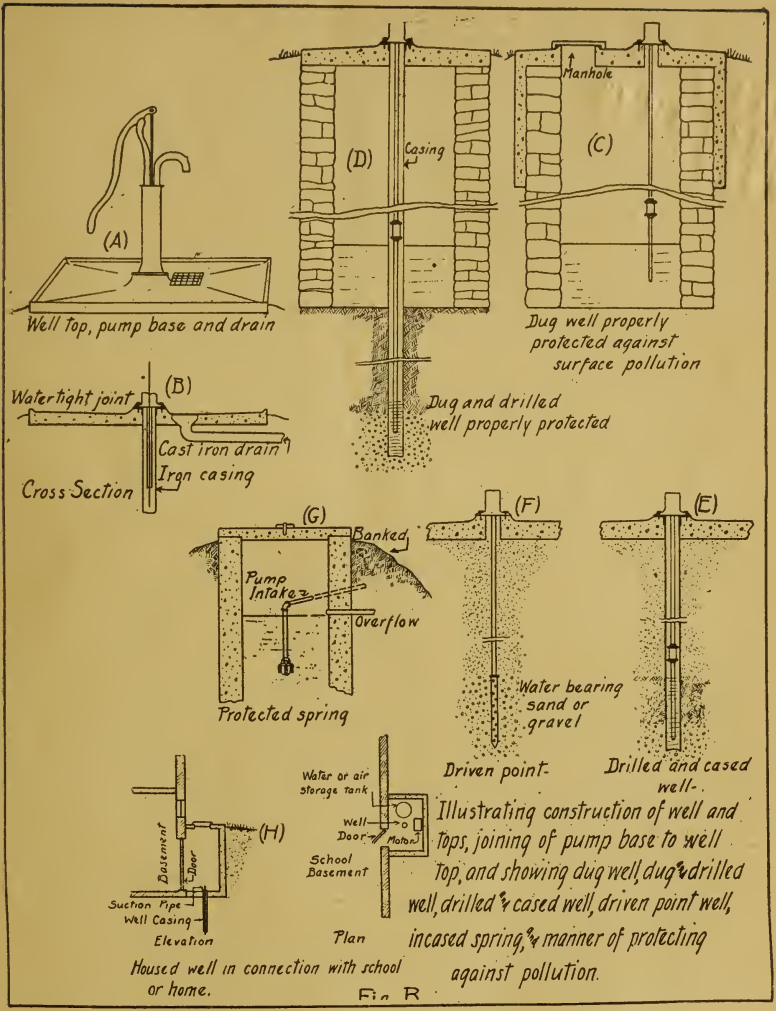

(A)
Well top, pump base and drain
(D)
Casing
(C)
Manhole
Dug well properly protected against surface pollution
Dug and drilled well properly protected
Watertight joint
(B)
Cast iron drain
Iron casing
Cross Section
(G)
Banked
Pump Intake
Overflow
Protected spring
(F)
(E)
Water bearing sand or gravel
Driven point
Drilled and cased well
(H)
Basement
Door
Suction Pipe
Well Casing
Elevation
Water or air storage tank
Well
Door
Motor
School Basement
Plan
Housed well in connection with school or home.
Illustrating construction of well and tops, joining of pump base to well top, and showing dug well, dug & drilled well, drilled & cased well, driven point well, incased spring, & manner of protecting against pollution.
Fig. R

FIG. 14.—IS YOUR WELL SAFE?

A high, tight platform with the ground sloped from the well keeps out the surface water and drippings. Curbing keeps out shallow seepage. Springs also need protection.

Manholes and Covers. Provide each tank with a manhole big enough to admit a man for examination or cleaning. If the top of the tank is 5 feet below the surface of the ground it is well to imbed iron rounds in the concrete for a ladder.

Cast iron covers may be purchased. Concrete lids are better if provided with lifting rings and made heavy enough that children can not lift them.

Air vents 2 inches in diameter should extend one foot above the ground so that a layer of straw to prevent freezing will not cover them.

Which Plan Must You Have?

1. Where there is a big slope below the house you may drain fixtures in the basement into the septic tank. For economy in digging it is best to have the tank far enough down the slope that there will not be more than 3 feet of earth over it.

2. Where there is less slope below the house it adds greatly to the expense to have the tank low enough to drain the basement. It is better to put it nearer the surface of the ground and near the house so as to save as much fall as possible for the absorption system. This would require that the laundry be on the first floor, or that it have a separate drain if in the basement.

3. If the ground has a fair slope below your house and the soil has sand or streaks of sand in it, plan on a septic tank with a siphon chamber and a system of tile for absorption. If there is no sand in the top 3 feet of soil, you may still use a tile absorption system, but you must have twice as much of it; use larger tile; and lay it in gravel, crushed rock or cinders.

4. Where both slope and space are limited, a dry well is the only means of disposal of the effluent from the septic tank. Put it where the danger of carrying disease germs to the well is least. If the subsoil is sandy the dry well is both effective and safe. In a tight clay it is safe, but slow in action, while in seamy soils or creviced rock it is effective but may be dangerous. Well pollution depends upon the direction of the underground flow. No absolutely safe distance can be established.

5. Where there is a ravine, swamp or river available for an outlet, apply to the State Board of Health for a permit to use it as such.

6. If none of these means of disposal are available, do not use a septic tank at all, but have an outdoor toilet with a deep fly-tight vault, water tight if near the source of water supply. Have an outside door through which the vault can be cleaned. Plow the contents under in a field.

7. Have the farm well on high ground where it will not receive surface water or seepage from any source of pollution. Then, for absolute safety, keep the toilet vault, dry well or absorption field of a septic tank as far away as possible.

8. When more specific advice is needed write the following information and send it to the State Board of Health, Bureau of Plumbing and Domestic Sanitary Engineering, or the Agricultural Engineering Department, College of Agriculture, Madison, Wisconsin:

1. How many people occupy the house?
2. Will the water from the laundry be drained into the tank?
3. Is the laundry in the basement, on first floor, or in a separate building?

4. Will the water from a milk house be drained into the tank?
5. What is the nature of the top 2 feet of soil—sand, loam or clay?
6. What is the nature of the subsoil—sand, gravel, clay or rock?
7. What is the character of the soil by feet to a depth of 15 feet?
8. To what depth is the soil reasonably dry?
9. What plumbing fixtures if any are to be located in basement—floor drain, closet, sink or wash tray?
10. How deep is the top of basement floor below the surface of the ground at the point where sewer is to leave the building?
11. How much fall has the ground between the house and the place where the tank is to be located?
12. How much fall has the ground between the tank and the dry well, tile absorption trench, field or natural outlet?
13. What is the source of water supply—a dug well, drilled well, driven point or spring? (Give depth of dug well, its protection, depth of drilled well and depth of casing below surface; depth of driven point; if a spring, its protection against surface and underground seepage. Also consider your neighbor's well).
14. Make a sketch of your premises showing the location of the house as to point of compass, proposed tank, effluent disposal plant, water well, neighbor's well, ravine, stream or surface outlet. Give distances, show by arrows the slope of land and give the amount of fall, all with respect to the house and slope of the ground around the house.

In cases with unusual difficulties it may be possible for a representative to visit the premises to determine the type of sewage disposal system that may be employed. The owner is asked to wait until the visit can be made at a minimum of expense and to furnish transportation from and to the railroad station.

The references to types of installations in the legends under the illustrations refer to like illustrations in the State Plumbing Code, of which the recommendations in this circular are abstracts. When writing for information, mention the name of this circular and the number of the illustration.

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